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Research For Architecture

Proceedings of the
AIA-NSF Conference
Ann Arbor, Michigan
10-12 March, 1959

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RESEARCH FOR ARCHITECTURE

An AIA Conference Supported by The National Science Foundation

Ann Arbor, Michigan, 10-12 March 1959

PROCEEDINGS

EDITED BY EUGENE F MAGENAU, AIA

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Foreword

The AIA-National Science Foundation Conference on Research for Architecture resulted from long-time explorations, by the national AIA Committee on Research and the AIA Department of Education and Research, of needs and the status of architectural research. It was significant and gratifying to find the National Science Foundation was willing to support our search for the fundamentals which will underlie all research for architecture.

Principal aim of the Institute with regard to research is to provide practitioners and educators with more and better tools for the design and planning of finer buildings and communities in every sense of structure, function, esthetics and economy. To this end the AIA set the following goals:

- AIA accepts responsibility for and will do research for architecture.
- the Institute will encourage other agencies to develop and carry out building research.
- the Institute will develop means to make results of research available.*

The conference was largely devoted to the subject of the first two items. Number three is well under way through services such as the Building Products Registry and the projected Index to Architectural Information.

It was recognized early in the work of the Committee on Research that the fundamentals -- knowledge of man, his needs, aspirations, behavior and abilities -- knowledge of total environment and how best to help plan it -- were areas outside those of the profession of architecture. As a result, advice was sought from other sciences as well as from architects and a steering committee was appointed to organize the AIA-NSF Conference.

**For amplification see AIA Journal (August 1958) report of Cleveland convention seminar on research.*

As a result of long study culminating with the conference, the AIA Committee on Research for Architecture is preparing an operational research program and organization for Board approval at its autumn meeting (1959).

Architectural research will be expensive and beyond the means of the profession for its sole support. However it is essential that the profession show its belief by modest financial support before we can enlist the aid of consumers, foundations or any other money source.

We are not embarking the AIA on any longhaired or unrealistic program of research. It is being developed with the conviction that it will prove of practical value to the individual architect, will increase the effectiveness and hence the prestige of the profession as a whole both in performance and leadership.

A digest of these Proceedings was published in the September and October 1959 issues of the AIA Journal.

WALTER E CAMPBELL, FAIA
General Chairman AIA-NSF conference

IN BRIEF...

Purpose of the Conference . . . from proposal to N S F dated 3 December 1956:

- 'to analyze the relationships of the physical, biological and social sciences in the problems of optimum created environment for human activities.

- 'to define needed basic research, both in the independent fields and in composite interaction.

- 'to explore the potential of basic research and determine the extent of research now being conducted.'

Summary Statement . . . from report of Discussion Group C. See Page 95.

'There was a high degree of unanimity among those present at the conference--including men from other disciplines, men already engaged in architectural research, and practicing architects--that there is a basic area of architectural research that deserves major attention at the present time.

'This area was described both as an area of clinical research and as a middle ground between the more specialized disciplines and the practicing architect. Research in architecture, as in comparable fields of professional service such as law and medicine, should be devoted both to the advancement of knowledge and the enrichment of service to the public. Progress may be made in stages, first ordering the existing knowledge, then pursuing solutions to questions now unanswerable, and finally adding to the store of fundamental knowledge as well as making withdrawals from it.

'Most of the research work now in progress in architecture is of an applied or developmental nature, since financial support tends to be concentrated on projects which explore detailed construction problems for industry or government, and since the projects basic to architecture tend to be more complex and less subject to investigation by conventional methods.

'It is important for architects to declare their concern for the more basic area of architectural research, to speed the development of appropriate research techniques, and to open the way for specially qualified research men to find a career of respected service within the profession.'

Highlights . . . the first conference on research for architecture considered:

- contributions and relationships of other disciplines to environmental and esthetic design
- criteria for future project proposals and support

There was general agreement:

- on need for such research
- on lack of trained personnel and current inducements
- on use of existing buildings for case--studies and data on failures
- on need for long-term support and continuity of cross-discipline meetings
- on avoidance of rigid definitions of basic and applied research

A RECAP OF SIGNIFICANT FINDINGS

Architecture

Architecture is a creation of a total environment within which can be accomplished the aspirations of man. We need a center and organization for research for architecture as well as studies at existing schools.

Architect's design responsibility is not the whole story--there must be studies in sciences underlying architectural practice (including economics) and clinical research in architectural theory.

Research may be of two kinds:

- passive: to make available predigested information
- active: new information and original thought to give depth and perception to design decisions and alternatives

Greatest professional challenge faced by the architect is that he finds too few clients of discrimination. Is it his social responsibility to meet low standards or to exert himself to better a performance which is neither understood nor valued?

Structures

There is great need for better communication between architects and between architect and structural engineer--whither architectural form? Increased use of model analysis is stimulating structural research. Architect needs familarity with new structural concepts.

Also needed are studies of complex interactions of composite structural materials and how to analyze structural form cut loose from the unit stress concept.

Psychology

Architects and behavioral scientists must learn something of each other's methods and data already on hand--must apply themselves to realistic problems.

Need study of organization-client--a vacuum of knowledge about social functioning of organizations. Architects should take responsibility for shaping the future and not feel that they must conform to a sociologist's prediction of it!

Forget sharp boundaries between disciplines. Avoid current fallacies of team and project research--people who agree to agree are not going to get very far in research. You cannot decide what you are going to prove. You cannot plan research.

Sociology

We need studies in architectural theory (professional practice theory), quite possibly non-academic in method and including relationships of individuals, physical and social environment.

Esthetics is least-developed area in sociology and psychology.

Planning

Conceptual or design responsibility of the architect has been outrun by technology. Designs are solutions of hypotheses--how can we research or teach in this field?

Problem-solving approach to creativity has been tradition. Need to define architectural problems in clinical terms in order to get help from other disciplines--or to develop the profession's own research talent.

Architectural research efforts and support should be centered on architectural problems--city planning, for instance,

currently has some recognition and support. Scope of design must be enlarged to help clear up the urban mess.

Architecture deals with problems and management of space, and needs evaluation of factors of environment. Basic fact is that you cannot plan without an inventory.

Do not confuse measurability of a research subject with its ultimate importance.

Environmental Hygiene

Research experience in this field offers profitable suggestions for architectural research.

Considerable evidence of induction of behavior by architectural form. There is a analogy with the nervous system.

Public demand creates support for research--which must be long-term.

OPENING REMARKS by the Conference Chairman,
at the beginning of the first day's session:

'I believe this is the first meeting of its kind built around the subject of architectural research and bringing together representatives of many sciences. There have certainly been meetings on a national level dealing with the whole subject of building research. We are making d distinction. We are interested in architectural research -- those things that we believe the architect is responsible for fostering and carrying out. It seems to some of us that this involves all matters that will be helpful to the profession. It deals with planning, with esthetics, with design, and we can't accomplish them without knowledge of how people behave. We're not interested, in these three days, in building-product development -- there is a whole area of building research which is being carried out and which is an enormous operation. So we're trying to keep this specifically aimed toward what we call architectural research. Many of us have tried to define it -- I suspect it will be re-defined, as long as research is carried out.

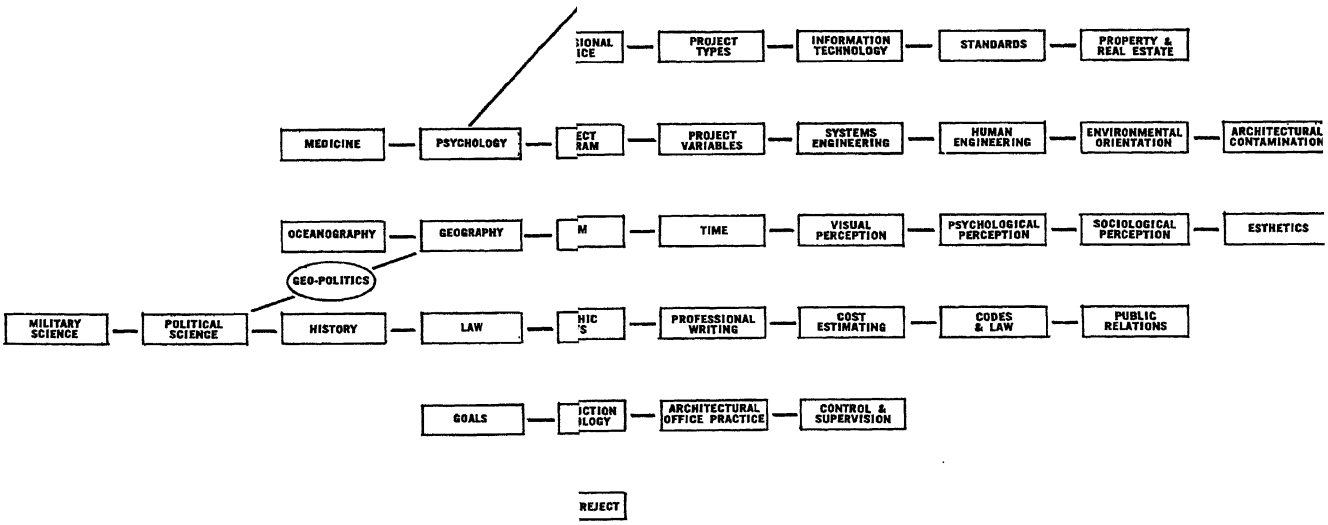
The Committee on Research of the American Institute of Architects, in its recent statement of architectural research, identified two areas of research in architecture as (1) research efforts of the practicing architect in solving his day-to-day problems by which progress becomes an evolutionary process; and (2) research relating to the functions of planning and designing of buildings based upon an understanding of human requirements.

Little has been done to stimulate and coordinate this type of research. It is believed that this conference will contribute materially to our objectives for the broad subject of research in architecture. We have indicated two objectives: (1) Analyze relationships of the physical, biological, and social sciences in the problems of optimum created environment for human activities. (2) To define needed basic research -- both in independent fields and in composite interaction. By pursuing these objectives, it is our hope that this conference can establish some criteria for basic architectural research through which projects can be authorized and supported. We are sure that other sciences will find useful areas of research as well, both for their own specialized fields and in composite interaction.

I'd like to say that creative design cannot and I think we all believe should not be reduced to formula. However, our tools as designers, and a basis of self-criticism, can and will be greatly improved and refined by combining our resources in this joint effort. Our job will not be finished until we set up an apparatus whereby the understanding gained here and the knowledge we hope will come, can be shared one with another. I'd like to suggest that we keep in mind, during the conference, ways and means whereby we can develop a permanent working arrangement. I'm sure we're all going to benefit by it as a single meeting, but I would hate it to be the beginning and the end.

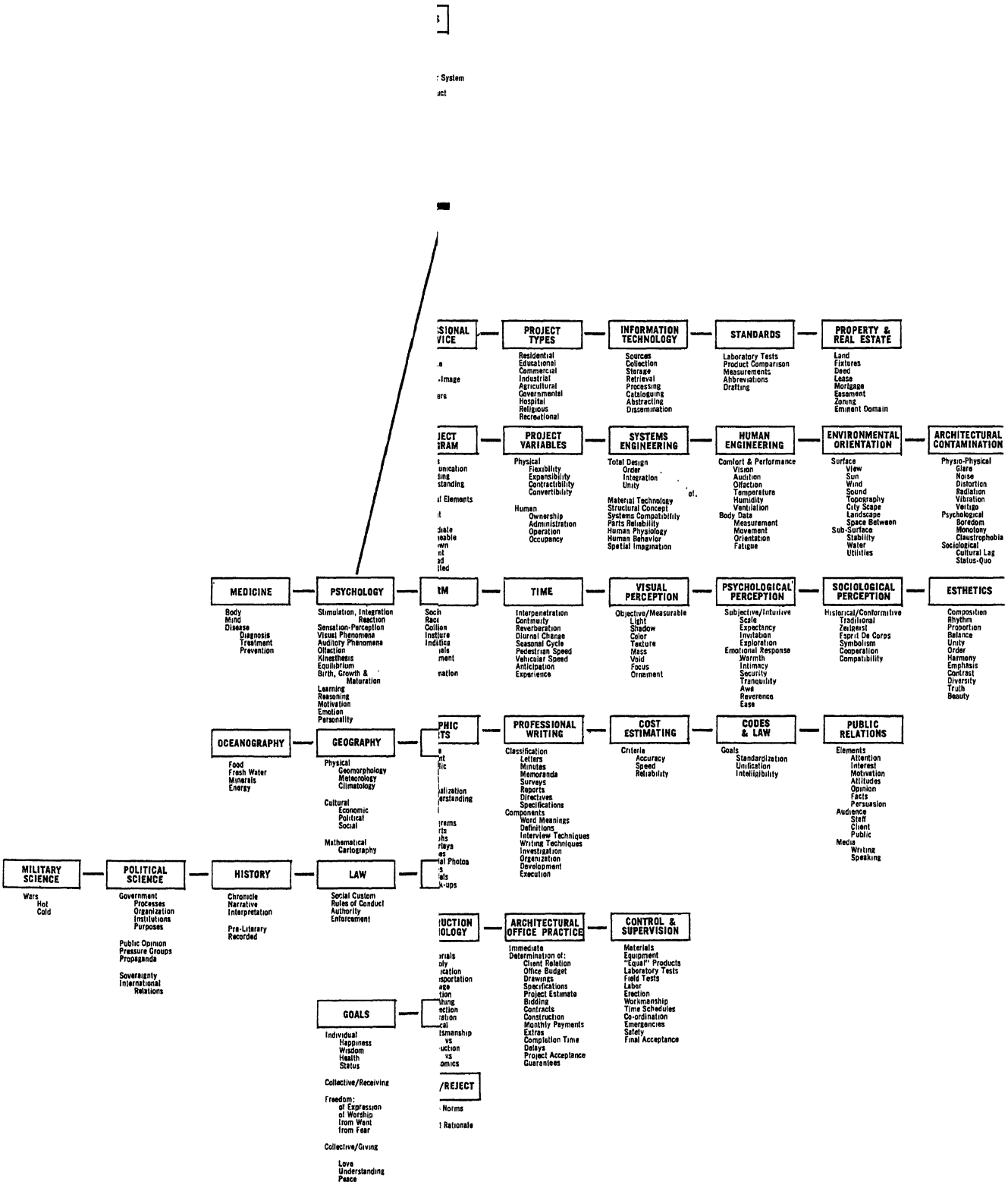
'IRST STATEMENT:

ARCHITECTURE.....ELEMENTS OF A RESEARCH NETWORK



SECOND STATEMENT:

ARCHITECTURE.....ELEMENTS OF A RESEARCH NETWORK



ARCHITECTURE....A RE-DEFINITION.

Herbert H Swinburne, AIA, Architect, Philadelphia

ARCHITECTURE. . . . Words and Meaning

A century and a half ago, Webster, defining the word 'Architecture', said it was the 'art of building; but in a limited and appropriate sense the art of constructing buildings for the purpose of civil life'. Today Webster defines the word in almost the same language except to say architecture is the 'art or science of building. . .' and with one word adds the effects of a century of Industrial Revolution to the concept of architecture.

The sticks and stones of shelter, submitted to the sophisticated manipulation of science and technology, have now become the buildings, great and small, of the 20th century. The public at large, and many architects, define Architecture in terms of separate buildings. These are thought of as an assembly of materials and equipment shaped to perform some function efficiently, economically and beautifully.

The physical aspects of architecture and its appreciation through visual perception is well understood, particularly as it relates to individual buildings - less so as it relates to groups of buildings.

I suggest, however, that today the definition of architecture, its concept by people everywhere, and its actual practice by the professional, is too limiting. It is too narrow in scope - only part of a larger picture. Too much of an emphasis on concrete physical evidence; too little understanding of man and society. Too little recognition of the true role the architect should assume.

Since man first met other forms of life and shared a natural environment with them he has been dissatisfied. He has constantly altered, changed and re-arranged his natural environment to suit his own needs and purposes. Today there are few areas in the world where man is still completely dominated by his environment. For the most part he is at least equal to it and manipulates small sections of it at will to make a more comfortable world. In the centuries ahead it is to be expected that he will eventually gain complete control over his total environment.

But these are physical aspects. Man must also live as an individual in groups of many sizes and as he alters the world he lives in, his needs, and the needs and purposes of the people in his society become controlling influences on the manner in which environment should be handled. New fields of thought are required here and the ultimate goals of man become a part of the picture in re-arranging the world to his liking.

Architecture then is not the art or science of building, especially for the purposes of civil life.

Architecture is the creation of a total environment within which can be accomplished the aspirations of man.

RE-DEFINITION. . . . . and Research

To build wisely as well as efficiently, we must learn more of man himself, or life itself. We must study man, individually and collectively, in all his variations, in order to know how to build for him. The

concrete aspects of the physical sciences are being studied incessantly, but the indeterminate, often abstract, aspects of the behavioral sciences are little known insofar as they affect the shape and use of our architecture.

A century of industrial revolution has so profoundly changed architecture it will never be the same again. It is suggested that a century of social evolution (and we are somewhere in the first half of it now) will have even more far-reaching effects on architecture.

Architecture and professional practice are changing rapidly, and acceleration can be felt as a changing society makes its demands for a new world environment. Magnitude of change is greater, rate of change swifter. Man must now adapt to new conditions in years where before he had centuries.

The architect must study man and his society so that while constructing the vast containers for all people and all activities he can be sensitive to their needs.

The role of the architect is to become a specialist in all branches of learning so that he may apply their principles to his buildings, to all space between buildings, to cities and whole regions. He must soak up more and more knowledge in so many diverse fields that, no longer a specialist, he now becomes a generalist. The architect is the only trained professional whose background must cut across all disciplines. He must use a panorama of knowledge as the backdrop against which he can create all new environment.

The role of architect will be to give that leadership which will create a vital quality that we can only describe as 'Dynamics of Atmosphere': A sense of destiny, a feeling of people on the move, a knowledge we are realizing the goals that will form a better society.

To do this the architect must embark on a program of accelerated professional research. He must organize swiftly and arrange for an attack on the gaps in knowledge. He must do this knowing full well that as an architect he can't do it alone; the field is too large and he is too uninformed. He will need specialists from all the disciplines. And this the architect must do quickly and well; certainly if he doesn't, others will. When the breakthroughs come, those who provided the leadership and the research will reap the benefits of such efforts. Research, then . . . well integrated, properly directed research . . . is not only necessary now, it is ten years late in getting started.

ARCHITECTURE . . . . . Structure of the Creative Process

Architectural research begins by placing those broad subdivisions of architecture first in relationship to each other as they are actually practiced in the profession, and, second to all other fields of knowledge that assist architectural practice.

Such is the chart: 'First Statement'. Study of this chart will show how architectural service can be broken down into well-defined segments, each one of which is a bite-size area of research. Not all items are 'architectural research'. Some of these segments are 'architectural research' and some are 'building research'. Both types of research are shown in order to give a full picture of all phases of architectural practice. Many of these segments are suggested for the first time as

it is felt they can contribute new ideas to architectural research.

The aggregation of researchable facets of architecture is shown tied to the knowledge of man through a research network. And the profession of architecture is linked to society by a communication system which I suggest be researched at once. Communication is our weakest link. Professionally we don't know society and certainly society doesn't know what an architect is. How can we supply leadership in achieving an optimum environment for society without mutual understanding and respect?

ARCHITECTURE . . . . . Elements of a Research Network

On the attached chart which we call the 'Second Statement': are listed a suggested (and incomplete) set of elements for each of the segments of architectural practice and other disciplines. First, let the author admit his incompetence in all the fields of knowledge shown, and, second, let him say he expects great architectural argument from his fellow practitioners because of his suggested re-alignment of many well-established and historically proper elements of practice.

The intent here is to take one individual element of research and find out how in exploring this subject it might relate to all other elements in architecture, and how it is connected through a research network to other branches of knowledge. It is truly amazing how other fields of learning already have a tremendous knowledge of some things architects so desperately need, but communication of data between the two fields is lacking. It is also equally amazing how much these other disciplines can help the architect in research.

The purpose of the chart is to assume an element that requires research, then to examine all other elements of any discipline that could have bearing on the subject and connect them all together with a linear network. This can give a visual outline of the overlap in fields of knowledge required to explore any subject.

RESEARCH . . . . . Needs and Priorities

This conference will produce, I am sure, well defined areas of needed research and some sequence of importance. Here are a few subjects for your consideration. They are given to you on the framework of three categories suggested by Robert K Merton as an array of problems awaiting investigation.

1. Problems in Architecture Generated by Society:

- One of the great problems in architecture is the client himself - - society itself when building. We have the client as individual, as a group, or the client in one of his institutional roles. Can these composite groups be investigated and certain classes of information established that will help the architect as he serves them? How does the architect's work as leader in the construction industry relate to the wants of society as distinguished from its needs? Do architects try to shape society or do we interpret it according to society's directive?

- Society has now created so much knowledge and accumulated so much data it is sometimes easier to investigate a problem oneself rather than try to find

where someone else already has done so. What new systems of information technology can be found that would place at the disposal of the architect the enormous mass of information in usable form that he needs so badly?

- One of the great urban problems of our time is traffic and transportation. Cities choked with congestion are being torn apart and rearranged around the automobile. Should we try to plan a little for the day 100 years from now when the only automobile will be in the Smithsonian? In one century we have seen cities designed to be anchored to seaports and rivers, next to the railroad, and now to a highway system. Can imagination design a city released from all traffic problems? As surely as we meet here today our grandchildren will simply jump into their air sled, connect to a community digital computer, dial inputs of destination, speed and altitude and be anywhere in a twinkling. Collisions will be impossible, air pressure constant, ride as smooth as silk. No airports, of course; freight will be dispatched to destination from factory, with automatic loading and unloading.

- What of a regional law system higher than the States to cover problems of solid state growth that will ignore community and State patterns? What will be the sociological effects as the right of eminent domain is exercised more and more? As population and land use increase the competition for all space will be bitter. How will we reserve and acquire land for its best use?

- The missile age has arrived. It has had no influence at all on our architecture. Should it?

- And what of air pollution?

2. Problems generated by ongoing experiences in Architecture:

- Since architecture is in itself a creative process, what are the principles of the creative process as it relates to architecture? Architecture cannot be reduced to a series of rules, but on the other hand, a great deal is already known about creative thinking, reasoning processes, intuition and systems of alternative development. How much of this can be used by the profession?

- The human organism reacts to its environment in countless predictable ways. Should the sociologist, psychologist and those versed in human engineering establish a series of known relations which, if built into a structure, would produce desirable results? or, conversely avoid undesirable results that we might call architectural contamination?

- Is visual perception the only way to experience architecture? Could we classify such things as sociological and psychological perception? Is it true that all the great works of architecture had the quality of all three forms of perception? Is it true that architects can see and understand beauty to such an extent that visual perception alone can be of such magnitude to make a work outstanding to them, and yet seem to fall flat with the general public because of an inexplicable lack of psychological and sociological qualities?

- Is it possible that the entire systems of architectural drawings, graphic arts and writing used by the architect are obsolete in terms of today's knowledge?

Should they be studied as basic forms of communication in terms of the audience they serve? Would this make for better execution of work with less misunderstanding?

- Can the method of systems engineering developed by industry in the last twenty years be interpreted successfully by the profession for its own use? Would this produce better performance and reliability in architecture while at the same time giving unity and harmony?

3. Problems of the place of the profession of architecture in society:

- The architect by virtue of his position and training is the only professional with a full perspective of society as it relates to needed changes in its environment. He is called upon to change the world continuously and is working with planners, engineers and economists. He is in the best position to assume leadership in his field since he works simultaneously in theoretical conception and practical execution. Should research establish for all architects, those methods which will help them assume leadership in their communities? Should general frameworks be established that will be a guide to each individual in setting up goals and the methods for achieving them?

- Research is needed to establish criteria for true professional architectural service. This criteria must be established in such a way that the architect can convey its essence to society. Since the architect is responsible for the creation of a total environment, he can't short-change society with the expedient solution. Have these services really been defined before? or are we just talking to each other? Do we really perform as we claim to do? Then let us communicate this to society on a realistic basis.

- Architecture as a profession, or as an art, or as a dynamic of the times, is so little understood by society. Are there any new systems of education, or of appreciation, or interpretation that can be considered to improve this situation? What is culture anyway? . . . . is it measured by pounds of chrome, or a method of understanding such things as form and color? Is it true that Americans (or any other group) have no feeling for the fine arts, the beautiful, the appropriate; or is there a remote possibility that appreciation, taste, fads and cycles are taught by 2nd and 3rd raters beginning in the elementary school system; by 4th and 5th raters in the high schools, and not at all in the universities?

A study of the chart on Elements of a Research Network may be used to develop further areas of required research in all three of Merton's categories.

RESEARCH . . . . . Frontal Attack

By 1960 Industry will be spending $10 billion a year on research and development. Today, in Science, Industry, Government, Business and, yes, even Education, those who do no research are soon outpaced.

So in Architecture.

One man doing research on one problem in architecture performs a useful service so long as he disseminates the results to one other person.

Let me outline, however, what might be considered a proper - not too ambitious - program of architectural research. Construction is a $50 billion a year industry with countless millions going into material and building research and into product research, but almost none into basic architectural research.

To establish a frontal attack that is already 10 years too late, the following would constitute a minimum program:

I. Research Study Group (Headquarters Staff)

Located in a city giving best access to all related disciplines and where one of the Country's leading universities, with one of the best architectural schools, is located.

Staff to consist of the finest minds that can be found in the various disciplines. All to be selected by a Research Administrator who would have properly established liaison with the AIA.

This group, in a fitting climate for exploring general problems in architecture, would perform needed research such as that suggested at this conference. Methods would be developed for cataloging, abstracting and disseminating all architectural research, not only of their own but that performed by others.

II. Contract Research

At least four or five research contracts would be given each year to various universities to perform specific explorations. These contracts would be monitored by the Research Study Group.

It is understood that integration of the disciplines is a difficult field requiring research in methods itself. And this might well be one of its first projects, particularly integration, in terms of architectural orientation.

It is suggested that in Research the most important word be 'Relevance'. The personnel employed shall be of the highest calibre; the purpose of the organization shall be clearly defined; and that which is sought for the most is clear understanding of each other's part of the work as it relates to the whole.

RESEARCH . . . . . and Cost

To put together a research team as suggested, to compete with industry for the best brains, to provide a proper working environment for the staff and to meet all overhead costs will average $35,000 a year for each scientist. Contract research costs in the universities would vary considerably depending on the subject.

Good research is costly.

Now, these sums could be reduced to zero dollars by donated time and research by individuals and universities. This would be disorganized, slow and would tend to be productive in terms of the interests only of those involved - not the needs of the profession as a whole.

The minimum annual cost for an effective research program is little short of fantastic. We must find the money from those who benefit the most by Research: from architects as individuals and from society at large.

RESEARCH . . . . . and Time

No program of research is predictable. One rule of thumb says that only one project in eight is successful in producing real results. The hardest moments in Research are those encountered in starting and setting up methods and procedure. Five years is suggested as the minimum time necessary for getting into production and accomplishing patterns of results.

It has been stated elsewhere this project is getting under way 10 years too late. Lets' delay no longer nor let others take the initiative.

. . . DISCUSSION OF MR SWINBURNE'S PAPER ON ARCHITECTURE

Harold D Hauf, AIA, Dean, School of Architecture, RPI, Troy, New York

In the lead-off paper this morning there were really two ideas welded together. The first one was--what is the architect's position in the scheme of things? Mr Swinburne is well aware that the future of the country is not going to be saved by architecture and architects alone and that the design of the total environment is going to have many other participants. My own feeling is that I am not even sure that the architect himself is going to be the key leader in this. I think this may develop in various localities because of the nature of the work undertaken. The leader of any group finally emerges not because of his special training but because of his human relations acumen. I would find it a little difficult to feel that the architect can become 'a specialist in all branches of learning and thereby become a generalist'. I believe there is a way to become a generalist without becoming a specialist first and I think it is almost necessary. Perhaps we can at least agree that we don't have to concede the architect's preeminence and get on with the business of architectural research.

The second idea is the concept of architectural research. What is its nature and how to accomplish it? I note that a differentiation is made between the terms 'architectural research' and 'building research'. Burnham Kelly nailed it down a little more and perhaps quite graphically by thinking of building research as the hardware side of the picture. He might accept architectural research as the design responsibility. But architectural research itself should not be thought of as just architectural design research. We must be careful not to define architectural research (let alone to distinguish between basic research or applied research) so closely that we rule out some aspects which are pertinent to the practice of the architectural profession as well as its design responsibilities.

Incidentally, the Building Research Division of the Canadian National Research Council - with a building research laboratory operating on a government budget of about a million dollars a year - began to be worried about what goes on in buildings and not just now to produce them. Therefore they

are setting up a division which they have called Functional Research which, I assume, is another word for architectural research.

The 4 November memorandum prepared for the Steering Committee by Dr Merton has some very cogent points on this distinction between technical research and architectural research. I find myself in complete agreement with his statement that the effort to formulate a precise definition of basic research in architecture would probably defeat its purpose.

We might define basic architectural research so basically that all the real problems fall outside of architecture and are found to be problems of other sciences! Dr Merton notes that basic research in architecture, as in other fields of professional work, is not all of a piece. It is useful to distinguish at least two kinds - research in the sciences underlying the practice of architecture, and what he calls clinical research in architecture itself.

He continues by pointing to experience in other professions such as medicine, which have activated fundamental research in science and have contributed to clinical research in their own right. This distinction might resolve some of the fuzziness as to just what is pure architectural research. Maybe we don't have to worry too much about how pure we are. I would like to suggest that Mr Swinburne's charts be given very careful study to show the integration and the intertwining of all of the things that go into architectural research or that might go into them, because you can use them to make up a definition of architectural research of your own.

I was delighted that Dr Foley brought along the definition of architectural research developed by the research committee at the University of California: - 'that inquiry which seeks systematically and deliberately to add to the body of knowledge and conceptual approaches through which architects may gain greater understanding and from which they may draw benefit in the course of their practice.'

The words 'in the course of their practice' particularly struck me. It seemed to recognize that research has to be implemented and tied together with Dr Merton's idea of clinical research. This understanding, which may be drawn upon with benefit in the course of an architect's practice, is also implicit in Mr Swinburne's Chart No. 2 in which he has organized what goes on in practice and how the results are achieved.

Dr Foley continues by urging that architects vary their design solutions to establish comparative analytic studies of the results of that variation. How do you know the solution you present is the one and that alternative solutions might not offer other advantages? There is a much broader field for investigation here than many of us may think.

Perhaps the lack of an activity of this sort within the profession of architecture is reason for a recent project to find out what the criteria for the design of university physics buildings ought to be. This was not started by an architectural group but by the American Institute of Physics. They have obtained a sizable grant from the Educational Facilities Laboratory of the Ford Foundation. The initiative for this sort of thing ought to come from the architectural profession and certainly the clients who have an interest in a particular building type have sources of funds with

which to carry on investigations of this type. (ed: AIA staff has been consulted from the beginning of this project.)

The US Public Health Service has done this for a long time in the hospital area, sometimes with the architectural profession throwing up its hands because prototype plans were being drawn for hospital medical and nursing units and sometimes going along because these standard plans could be used as take-off points for further study. But I believe in the need for these building type analyses.

There is another area of this broader definition of architectural research which seems to me to have been short-changed on the agenda, and that is the whole question of building economics. There is scarcity of information on whether alternative schemes within one building type are any more efficient or any more costly, or both.

I have become involved recently, as a consultant, in the New York City School Construction Inquiry established to examine the charges of waste and extravagance made by the Comptroller of the City of New York. One of the charges was that the Board of Education had not sufficiently implemented the concept of re-use of architectural plans. Now the Board had re-used plans in several instances where it appeared that the program and the population of the school, and the site was about the same but the Comptroller's office claimed major savings could have been made if the Board had re-used plans something on the order of 200% more than they did use them.

The Special Committee headed by Dr Hale of the Ford Foundation, Dr Hunt of the Harvard Graduate School of Education and Max Rubin, a New York attorney, in attempting to get to the bottom of this, asked whether it would be possible to make an analysis of several particular schools upon which architects had been employed to make new designs and then go back and look at the available plans that could have been re-used at that time and come up with a yes or no as to whether the Comptroller was right or wrong in saying that these plans could have been used more economically. Now, to some of us in the building field this appears to be an impossible question. On the other hand, to many lawyers it looks as though you ought to be able to give an answer. There is no authoritative data on this because, in spite of the claim originally made, it is obviously clear that you might have been able to use an architect, pay the 4% or whatever the fee is for redesign of the plan, and still build a building cheaper, rather than re-use a set of plans that was five years old and designed for building market conditions which were quite different. Yet there are no data on which you can base this. It just cannot be done and I submit that there is a field here of building economics needing study. It certainly isn't the kind of architectural research that you get the other sciences to do. We need to be able to implement our design responsibilities in both the economic and the political climate.

A central agency for a bureau of architectural research information is probably one of the most useful things we could get. However, I believe we can make better pro gress faster by developing existing research resources than by setting up a central research bureaucracy such as the one for which the blueprint was given this morning in Mr Swinburne's paper.

John Lyon Reid, FAIA, Architect, San Francisco

'MAN - THE ROOT OF RESEARCH'

The objectives of this research inquiry of the American Institute of Architects, both stated and implied, say that organized, concerted effort might be made to push back the frontiers of knowledge and to bring this enlarged understanding of man and of architecture to serve the architectural profession that it may provide leadership to the building industry and promote the public welfare. I think it is generally agreed that the need and the opportunity exist, and that there remain the problems of the formulation and the execution of the program and the dissemination of the findings.

At this point,. some qualms exist in my own mind and these revolve about the fear that this program may not reach its potential of accomplishment. My doubts involve the efficacy of a research effort where architects and respected scholars of other disciplines exchange views, share work, mutally benefit and transmit findings, all within the family. More later.

But first, the question of researchism has already been raised. It seems reasonably easy to draw the line separating on the one hand, the doubtful value of research effort that will make available the pre-digested thinking and the kind of inquiry that would simply ease or replace the normal work effort of every architect, and on the other hand, the providing of data, statistics, analyses and original thinking that would give depth and perception to the design decisions and their alternatives that represent so significant a part of the professional effort of the architect. The latter kind of research finding is not expected to reduce, but rather to sharpen and extend professional effort.

The field of research inquiry that embraces the mechanical, structural and presumably the more material aspects of architecture are more manageable as research areas. The architect, happily, is changing from his once alleged artistic detachment to a different kind of professional frame of mind from which he regards the bones, intestines and arteries of his building not only with a genuine interest and affection, but sometimes also with the speculative eye of the artist. With all due respect to the problems faced by Professor Holley, I believe that I can see the welcome end of the era where the architect-esthete insists on illogical structure as a necessity of architectural expression over the protests of the practical engineer. I have worked with structural engineers who have poetry in their souls, and I have ssen architects who are knowledgeable about the principles of structure. Such teams will envisage structures worthy of the kind of research program we hope for.

More elusive are the fields of inquiry that involve psychology, sociology, economics, politics and other fields. Meaningful programs are difficult to formulate and results are not easy to evaluate. And yet the field of man, his behavior, his thinking, his social, political, economic and religious traditions and current practices represent a field where the contemporary architect is most in need of help.

Architecture has reflected the image of man, and inspired him. It has been re-

garded, and still is, as an art having to do with buildings, the 'one-of-a-kind' variety having attributes of uniqueness, completeness, quite often permanence and even monumentality. In our day of rapid obsolescence, transitory values, shifting populations with changing needs, we are forced to extend the meaning and substance of architecture. Architecture means all that it ever did but its forms, its expression are perhaps changing. It may in some cases be a system, or an organism that is expanded, contracted, altered, or repeated, sometimes by the architect, sometimes by the client without benefit of architect. It is more and more a veritable 'do-it-yourself' architecture. It formerly gave strong evidence of the hand of the architect; now it still does but increasingly evident is the hand of the client.

The client was most often an individual; he may still be, but more frequently he is a group or a corporate body. Because of the increase in his participation in a priori design judgments as well as his continuing design influence and activity after the building is completed and occupied by himself, through his arrangement of furniture and furnishings, alterations and usage, it would be prudent to consider not only the design impact of the architect but of the client as well.

The research program that we discuss will attempt to extend the frontiers of our knowledge and feed it back to the architect. Means will be found to place this in the hands of the professional in order that architecture may not only serve man more effectively, but will enhance, deepen and enrich his envrionment and his life. Can this be accomplished if the architect is the only recipient of the promised riches? If I am right in believing the client to be a force of significance in today's architecture, is he capable of using, manipulating and understanding the tool or the art, if you will, that he has helped to create?

There has been much current speculation about man and his environment. Is he sensitive to the low standards of design that are typical of our buildings, our city streets and our cityscape as well as the suburban tract of homes? Is he aware of the bad planning of our cities and of its effect on him? If he is aware of these things, he gives precious little evidence of it. The American automobile, which Detroit tells us is exactly what the man in the street wants, does little credit to his taste and design judgment. Are his values as low as we think they are, or is he the victim of the salesman and the public opinion poll? I don't believe we really know. Then, by all means, shouldn't we research this problem and find out?

If we did find out and if we could be sure of the validity of the research, would it do us any good? It may be that the movements of the larger forces of society are more effective in solving this problem than the efforts of the architect. The architect himself is a part of the public and often one's imagination must stretch to believe that the architect's vision of man's potential is so unerring and enlightened that he alone can make a better world for his fellow man. If we were to conduct research on the values held high by the American public, then I suppose we must conduct simultaneously a second research program to tell us what to disregard in the findings of the first.

In spite of many examples to the contrary, the architect finds too few clients of discrimination, either individual or corporate, that value his artistic competence. If the architect really hopes to serve the public welfare effectively, he finds too little de-

mand for the artistic leadership that the American scene so badly needs. If I am right in recognizing the critical role that is being played in increasing measure by the people, then the architect finds himself in a dilemma: should he give his client a service which meets the suspected low standards of the public or should he perform to more demonstrably valid standards which are neither understood nor valued? This dilemma for the architect is not a matter of getting business, but rather a matter of social responsibility.

If research in this field can be considered productive of meaningful results, and I think it can, means must be found to make its results known and intelligible to the public with whose welfare the architect says he is concerned, Such an objective, however, would be formidable and complex. Yet it is my opinion that this is the greatest professional problem or challenge faced by the architect, and without some solution to it, partial or otherwise, the architect will not realize his full powers.

Well organized research will undoubtedly be able to serve the architect by giving him answers and facts that he does not now know. More likely, it will give him much that will make his assumptions, guesses and decisions much more educated than they are now. Importantly and also parenthetically, it involves and I hope interests, men of skill and competence in related disciplines such as those with us here, much to the advantage of the architect. However, guesses and assumptions, made usually on an intuitive basis or on meager information, are used daily by skillful and creative architects. These sometimes probe the perimeters of our limited knowledge. The completed buildings which result are invariably carefully examined and occupant behavior is watched by the architect of the building. Too seldom are trained observers and analysts from appropriate disciplines enlisted for study and too seldom are results made available to the whole profession. There are no doubt many projects that are useful as case studies. Architectural periodicals for many and obvious reasons have not been able to serve our profession in this way. Data and information thus secured, when disseminated would prove useful in the creative process.

I have attempted here only a statement on two points: (1) that the public as well as the architect should receive directly, appropriate benefits of a research program, and (2) that the end result of architectural effort and thinking serve as case studies. When the underbrush is cleared away through meetings and discussions such as this, and when we know better what to expect from research, the practicing architect will welcome its help as strengthening of his service.

THE ARCHITECT'S ROLE IN STRUCTURES RESEARCH

Myle J Holley, Jr, Professor of Civil Engineering, MIT

For one who is not an architect to prepare comments under the above title is, perhaps, to risk the accusation of presumption. It seems, desirable, therefore, to acknowledge a considerable ignorance of the overall problems and practice of the professional architect (accompanied by a very real respect for his accomplish-

ments), and to acknowledge further that these comments must in fact be a reflection of the writer's particular experiences in the teaching and practice of structural engineering. Through these experiences has come a belief that the cooperation between architects and engineers, which has so often been productive of outstanding designs, might well be strengthened in the area of structures research. Indeed in that aspect of structures research which has been mainly the concern of the structural engineer, namely the area of strength-stiffness behavior, progress would be accelerated through a closer cooperation of architects and engineers, including certain specific research activity on the part of the architects. The purposes of this paper are to establish the interdependent interests of architect and engineer in this area, to indicate major problems, research objectives, and methods of attack, to suggest participative efforts which might be sponsored or undertaken by the architectural profession, and to urge steps toward improved communication between the two professions.

It should be unnecessary to argue the co-dependency of architects and engineers in the general area of design. Yet the very factors which demand their close cooperation sometimes create unfortunate misunderstanding and frustration. The architect has a primary responsibility for the conception of beautiful and useful structure in the great majority of buildings which our society requires. By training and breadth of viewpoint he is best suited to this difficult task. Yet this very breadth precludes his mastery of each of the many disciplines involved in the translation of his ideas into the reality of a completed structure. (One excludes, of course, the exceptional few who disprove the statement). Accordingly he draws upon the talents of a number of specialists including the structural engineer. However, the relationship between architect and structural engineer is likely to be more delicate than the corresponding relationship with other specialists. The reasons are obvious. The structural engineer may be asked to judge the load-supporting capabilities of a form suggested by the architect, or to furnish a load-supporting system within the given form. His concerns are primarily with strength, stiffness, and economy, and to him the suggested form may be illogical, impractical, or even impossible. To the architect on the other hand the structural form may well be the very essence of his creation, and such criticisms are understandably unacceptable. Thus we hear the structural engineer accused of narrowness and lack of imagination and the architect accused of impracticality.

The foregoing description is, of course, somewhat overdrawn, and a harmonious cooperation is perhaps more typical. Still, in varying degree, the conflict does occur. It is perhaps intensified by the extent to which architects and engineers practice each other's role and thereby acquire a real or imagined competence in the other's field. For example there are certain types of projects for which the engineer is logically and properly the principal, serving as creator and coordinator, but he may overestimate the range of situations for which his talents are adequate to such a role. On the other hand the architect, knowing that the solutions to many of the problems which he poses to the engineer are well within his own capability may become somewhat contemptuous of the engineer's contribution and he may overvalue his own ability to perform the latter's function.

These comments on factors which cause friction between architect and structural

engineer are by no means irrelevant to a discussion of the architect's role in structures research. This friction frequently finds expression in the architect's exasperation with the engineer for the latter's inability to verify the strength-stiffness sufficiency of a suggested form. Sometimes this charge is unfair because the architect has, in fact, conceived a form which is totally inappropriate from the standpoint of load resistance. On the other hand it must be acknowledged that the engineer is at times quite unable to judge the suggested form, or unable to perform the analysis required for a judgment in the available time. In either event through structures research and through education we may reasonably hope to eliminate this frustration. The engineer requires better understanding of certain aspects of structural behavior and better techniques for evaluating probable behavior of specific hypothetical systems. These will enable him to provide the architect with prompt judgments and perhaps with certain specific guides which will increase the frequency of favorable judgments. The architect requires, in addition, a better understanding of the general strength-stiffness characteristics of the various configurations which he adapts to his purposes. Without research these goals are not to be realized.

The foregoing remarks may suffice to establish the need for structures research and the potential values of research effort in terms of future capabilities of architects and engineers. It would, of course, be absurd to infer any general inability of the structural engineering profession to cope with the problems of building design in the present era. Rather it should be inferred that research is needed to insure that the grasp of architect and engineer alike shall not be needlessly shorter than their reach. A sense of urgency is perhaps suggested by the happy circumstance that we live in a time of rapidly lengthening reach.

The most promising areas of structures research may best be indicated by reference to what has recently been 'conventional' in the philosophy of strength-stiffness analysis and design, and by comment on what may be viewed as significant modifying trends. The traditional concept of acceptable strength-stiffness behavior involves (1) a useful range corresponding to elastic limit values of nominal unit stress (2) anticipated working loads limited approximately to the lower half of the useful range. 'Structural Analysis' has been concerned with methods of determining internal gross forces (thrusts, shears, bending moments) in component parts of structures. 'Strength of Materials' and the 'Theory of Elasticity' have involved the relationships between these gross forces and the unit stresses and deformations which they produce. Experimental structures research has supplemented and modified theoretical relationships between internal gross forces and unit stresses on the one hand and member distortion and capacity on the other. 'Structural Design' has included the development of criteria for judging structural behavior and for proportioning structural components to assure desired behavior.

As the preceding paragraph indicates the development of structural engineering has been dominated by the "unit stress" concept. Mathematicians, elasticians, and structural analysts have labored to produce techniques for evaluating the internal gross forces and the unit stresses in a variety of complex assemblages. It is in no sense a reflection on the value of their contributions to confess that the state of

the art and science of analysis has constantly lagged behind the needs of structural designers. Where the demand for a specific structural form has been sufficiently insistent, the merit of that form sufficiently obvious, but the analytical tools inadequate, the engineer has utilized test data and judgment to formulate empirical methods of design to satisfy the demand. One might cite, as an obvious example, the reinforced concrete slab or plate although numerous other examples would do as well. Even in these instances of forced deviation from the strictly analytical approach, however, it should be noted that the end product usually has been a set of design criteria involving computed nominal unit stresses. Sometimes these stresses correspond closely to actual stresses; in other cases there is no close correspondence and they might more logically be given a different name. Parenthetically, it should be noted that lack of correspondence between actual unit stresses and computed values is not a matter for concern provided permissible values of the latter properly reflect the evidence of experiment and experience and thereby assure the desired behavior. Unfortunately some engineers assign to all computed unit stresses a degree of reality which is not always justified.

The pre-occupation with unit stresses characterizing much of the modern history of structural engineering has been beneficial in some respects but unfortunate in others. Perhaps the most important benefit has been the development of practical methods and criteria applicable to the design of most of the structures which man has required in modern times. Wide acceptance of the logic of these methods and criteria, justified by a remarkably fine service record of actual structures has permitted the codification of basic rules and the training of vast numbers of engineers capable of proportioning structures for satisfactory behavior. Without these the rapid technological progress of the past two centuries would not have been possible. However a number of developments of the recent past suggest that the unit stress concept of structural engineering is too restrictive and that it must be viewed as but one approach to the problem of proportioning structures for desired behavior. Failure to appreciate this fact has lead to a reluctance on the part of many engineers to undertake the proportioning of structural forms for which methods of stress analysis were not yet available. This reluctance has been particularly apparent when the demand for a new form was not insistent and when the scale of the proposed construction was deemed too large to permit the development of empirical methods through experimental data. Of course there always have been a few less inhibited thinkers able and willing to undertake the novel, engineers who have kept abreast of the latest developments in theory and in research results and who have pioneered the applications of significant new knowledge. That such engineers are never as typical of the entire profession as we would wish may be due in some measure to certain deficiencies in engineering education. It is so much easier to teach the mathematics and mechanics of analysis than to teach the realities of structural behavior or to generalize rules for fundamentally good design! The writer can report that this aspect of the problem is understood in some educational quarters and corrective measures are being undertaken.

The preceding comments will perhaps suffice to indicate limitations to the capabilities of the structural engineer which are inherent to the conventional methods of

analyzing and proportioning structures. Fortunately recent developments in several areas have provided at least a partial release from these limitations. Through research a far greater freedom for the engineer, and thereby for the architect as well, can be achieved. Recognizing that any attempt to list the most promising areas of structures research, must provoke disagreement from those who are in any way involved, the writer nevertheless suggests the following:

(a) Applications of electronic computers to the problems of stress analysis.

(b) Extension of the ultimate strength and limit design concepts.

(c) Utilization of probability theory to relate working load and required strength.

(d) Development of model analysis as a source of general knowledge of prototype behavior and as a design tool.

Before commenting on the significance of each of the above topics, it must be emphasized that no implication of unimportance is intended by the omission of several others. For example, the continuing efforts of applied mathematicians in the fields of elasticity, elastic and inelastic stability, are essential to overall progress in structural engineering. Similarly, widespread experimental research in the behavior of structural components must not be discontinued. These and other areas of structures research are omitted from the present discussion only because they do not reflect basic changes in concept or method.

Within the structural engineering profession there is very great interest in electronic computation, and the use of this new tool is rapidly increasing. There are many structural forms for which methods of stress analysis, while known, have been too costly in time or money. The electronic computer removes this obstacle. Furthermore, this tool will permit the computation and tabulation of stress solutions for recurring structural forms, thus expediting the solution of specific cases. Under some circumstances the computer can be asked to select an optimum design in accordance with given criteria. Quite naturally both engineers and architects recoil in some horror at this latter application, but it is possible to assure them that there appears to be no reason to believe man's creative and analytical talents will be supplanted by the machine!

The electronic computer may perhaps be regarded as an infinitely superior slide rule. As such it will increase the structural engineer's capability of performing strength - stiffness judgments of proposed forms. Parenthetically the architect too may find important uses for electronic computation in (non-structural) areas of research which are not here under discussion. With regard to the architect's role in structures research the advent of electronic computation does not appear to be particularly significant. Perhaps it justifies a research effort on the part of the architectural profession with the objective of defining the recurring structural forms of greatest interest. It is not anticipated that electronic computation would be utilized in such a study, but rather that the end product of such research would generate strength - stiffness analyses by research groups of structural engineers.

Ultimate strength and limit design concepts are not particularly new, but recent

progress in this area has been rapid. Terminology employed by the proponents of these concepts is not completely logical. In the field of reinforced concrete ultimate strength proportioning implies that internal gross forces are determined on the assumption of elastic behavior but that component parts are proportioned for ultimate strength values which are specified multiples of the working load internal gross forces. Limit design implies proportioning of an entire structure so that collapse of the whole, or any component part, will occur at a specified multiple of the working load. The ultimate strength concept, as above - defined is noteworthy, first, because it dispenses with the unit stress criteria, second, because it has been adopted as an alternate method in the building code of the American Concrete Institute and, third, because it represents a first step in the direction of limit design. The American Institute of Steel Construction Specifications soon will permit the use of limit design methods, and the ACI Building Code probably will do likewise in a very few years.

It is to be noted that the limit design concept not only dispenses with unit stress criteria but also eliminates the elastic analysis for internal gross forces; the latter are obtained by the relatively simple application of equations of static equilibrium.

Thus far the ultimate strength and limit design concepts have been applied mainly to relatively simple structural forms (continuous beams and indeterminate frames) which were as easily handled by conventional methods. The incentives have been a more rational relation of structural capacities to working loads and consequent reductions in the required sizes of component parts. While these benefits are of some consequence the implications of the concepts employed are much more significant in terms of their probable future application to structural forms for which unit stress solutions are not available. Although the desired behavior of a structural form cannot always be stated solely in terms of a required minimum failure load this criterion frequently is of predominant importance. In such cases the significance of the limit design concept is obvious.

There does not appear to be any occasion for the architect to participate directly in the kind of research effort needed to extend the application of this concept to more difficult structural forms. It does seem clear, however, that architects should become accustomed to thinking in ultimate load terms in order to facilitate communication with engineers in the future. Moreover, familiarity with ultimate load concepts is desirable in connection with possible participation in research related to the utilization of probability theory.

In the conventional approach to structural design there generally is no attempt to relate the factor of safety to the specific conditions of a particular installation. Rather the factor of safety is implied by the ratio of permissible unit stresses to yield values of the material properties and by the choice of 'Design Live Loads' which may be somewhat conservative. The use of ultimate strength criteria rather than unit working stresses permits a more rational specification of factor of safety. On the one hand the computed ultimate strengths can be made to reflect the probable influences of uncertainties in material properties, degree of construction quality control anticipated, etc. Similarly the choice of load factors can be based on the probability of developing particular load intensities within the intended service life of the structure. This approach has, to date,

seen little application, but is receiving increasingly serious attention. It appears to offer the possibility of much more rational relationships between loads and strengths. In the writer's opinion it is very much in order for the architect to familiarize himself with the concepts involved and to initiate research directed toward a better definition of probable loads.

Regardless of a constantly improving capability for analytical evaluation of structural behavior it appears that this capability alone never will be completely equal to the demands imposed by newly devised structural forms. A supplementary technique is required, and there is reason to believe that this may be furnished by model analysis. With a few exceptions this technique has been but very little explored. Indeed if but a fraction of the effort which has been devoted to the improvement of theoretical analysis had been spent instead on the development of model analysis the latter would almost certainly be a thoroughly practical approach at the present time. For a few specialized structural types, (notably for dams) remarkably useful techniques have been developed over the past decade or so. There is every reason to suppose that these successes can be extended to a variety of important cases in the field of buildings, but a very considerable research effort will be required. One can imagine a time when methods of analysis involving models will supplement, though not supplant the theoretical approach.

In any research directed this way it would appear that cooperation between architects and engineers would be most desirable, the architects contributing, in particular, suggested forms for general model analysis. In addition it would seem that a successful development in this area would be of immense assistance to the architect through improved understanding of the physical behavior of a variety of structural forms.

Much of this paper has been devoted to the reasons for present limitations in the field of structural design, and to the reasons why these limitations cause difficulties in the architect-engineer relationship. An attempt has been made to indicate how structures research can reduce these limitations and thereby improvethe capabilities of architect and engineer alike. It is hoped that a better understanding of the structures problem may lead to better communication between architect and engineer and to joint effort, wherever possible, toward the common goal of finer structures.

. . . DISCUSSION OF MR HOLLEY'S PAPER ON STRUCTURES

Albert G H Dietz, Professor of Building Engineering, MIT

Materials - Influence on Structures

As suggested in a previous discussion with our chairman, the topic of structures is viewed largely from the standpoint of materials. A few additional observations are made.

Although the analysis of structures is basically independent of the materials of which the structure is built, ultimately the properties of the materials do exert an overriding influence and set limits to what is possible in a given design. Research in structures must therefore take into account

the properties of materials, their possibilities, and their limitations. Materials set bounds but at the same time challenge the imagination and ingenuity of the designer, both architectural and engineering, to make use of their properties to produce structures that are sound, economical, functional, and aesthetically satisfying, that is, to produce the control over environment that is the architect's role.

From the standpoint of structure, materials may set limits of inherent strength, deformation and form. Closely related are functions such as heat transmission, acoustical control. light transmission and resistance to weather. A measure of the success of a design lies in the degree to which all of these are met by the judicious choice of a group of materials combined into a structural form that best provides for the functions to be sheltered in that structure.

Some materials have limitations of form, either inherent or imposed by manufacturing processes. Some, for example, are most easily and best produced as linear elements or flat sheet. They are most adaptable to framed structures or, at best, simple curves. Other materials have no inherent shape of their own but must be formed into their ultimate geometries. These may find their best use in compound curves. Some materials are strong but are not stiff. These must be used in forms having inherent rigidity to offset the limited stiffness of the material. Some materials are strong but not ductile; they will not easily yield to redistribute internal stresses and strains. Many materials are strong and stiff but opaque; a few have good strength and are translucent or transparent but possess other limitations such as brittleness or lack of stiffness.

Although much is known about the properties of many materials, much must still be discovered. Basic strength properties -- tension, compression, flexure, shear, modulus of elasticity -- are easily measured and for most materials are quite well established. Seldom, however, do these stresses exist in pure form in any structure, certainly not in the shells and free forms today proliferating in all manner of structures. Usually all of the different kinds of stresses are present in complex interactions aggravated by such factors as temperature changes and changing loads. The behavior of materials under such complex and changing conditions is most imperfectly understood. Finding the answers is a long, arduous undertaking, many aspects of which are not to be hurried. Much research is needed.

In many ways the field of composite materials in structures is the most exciting and promising of all. Seldom will one material fulfill all the requirements of a structure. Several must be used in combination, each contributing to a composite having properties possessed by none of the constituents alone. The structural sandwich is an example. By combining hard, strong, thin, dense facings with light, thick cores, a geometry results having great strength and stiffness with minimum weight and, often, good thermal characteristics. This combination, simple though it is, has by no means been completely explored from the structural standpoint, and the implications of combined structure and enclosure, possibly combined with light transmission, are not fully explored. When this is combined with the possibilities in curved shapes such as shells, the extent of our knowledge is still more limited.

Research in materials is by no means finished business. It has hardly begun. And

because it is still in a highly imperfect state, it sets limits on structures because the two are inextricably linked.

Although materials set limits on structures, each new material that appears opens new structural possibilities and, in turn, each new structural form that appears opens new possibilities in the use of materials, both new and old. A case in point is the new reinforced plastics, just beginning to be experimented with in building structures. Strong and light in weight, often highly translucent, these materials have no shape limitations because they have no inherent shape. They must be given form; moreover, because they are relatively low in stiffness and fairly costly, those shapes must be inherently stiff and economical of materials. Shells and sandwiches are indicated. Many new possibilities in light weight structural forms, combining enclosure, structure and light transmission are opened. But weatherability is still not completely established; and reliably reproducible and economical fabrication processes are still to be fully developed. Research in these directions must go on while the architect and engineer explore the structural possibilities of this new class of materials. Even more, the possibilities in combining these materials with others, already established in buildings, require imaginative exploration and thorough research. Many other new materials, now appearing or just over the horizon, will require the same combination of solid research and imaginative application.

Is there not a danger that the ability of certain materials to be formed into almost any shape may lead to an over-emphasis on shape and form for its own sake? May not the sound concept that structural form should conform freely to the requirements for the enclosure of space be perverted into a fetish or fad? Is it necessarily true that the bizane curve is the right structural form to use, or is it merely the latest cliché, like the jigsaw fretwork of another era?

Research in structures and structural forms must be on a sounder basis than fad and fashion. Certainly it is true that architecture must be freed from the restrictions of traditional form and traditional structures. The right structural form for the intended use should be available, and the methods by which these forms can be analyzed must in themselves be the subject of research so that our present often uncertain, slow and cumbersome analytical processes can be greatly speeded, made more flexible, and capable of predicting more accurately the behavior of structures of whatever form best fulfills the requirements of a given use.

Imaginative approaches are needed, the ability to look at a structure as a whole and to develop a sure intuitive feeling for its overall structural behavior must be cultivated. Here architect and engineer should work closely together, the skills and experience of each supplementing those of the other in setting up and prosecuting research.

Perhaps a research approach based on strain and deformation of the structure and its parts, rather than on the concepts of stress may prove fruitful. Professor Holley has shown that traditional ideas of stress are in many ways meaningless in the analysis of structures. To a materials specialist the concept of internal stress among the atoms and molecules of his materials is difficult to grasp or to envision, but the concept of atoms and molecules being separated or rearranged because of ex-

ternal influences is easy to visualize, and the idea of critical displacements leading to yielding or rupture follows readily. Perhaps such concepts can be extended to the deformation of structures, critical deformations or strains leading to failure. Model analysis, which depends on the observation of strains and deformations directly, should lend itself to this kind of approach. Model analysis also almost necessarily implies observation of the structure as a whole, rather than preoccupation with details.

To summarize, materials set bounds to the possibilities of structures but they challenge the imagination and ingenuity of the engineer and architect to employ them to best advantage and to circumvent their limitations. Research in materials is by no means finished business but needs to be pursued vigorously to overcome the limitations they now set on structures. New materials and new structural forms interact on each other to open new possibilities in structures for the use of the engineer and the architect in solving the problems of best providing enclosure and shelter.

. . . SECOND DISCUSSION OF MR HOLLEY'S PAPER ON STRUCTURES

Fred N Severud, Consulting Engineer, New York

Research by Observing and Recording Defects

I have the strong conviction that within the field of structures we should not wait for a full-fledged research program, but start right where we are and develop a group that can cull the abundant information already available in the field. Within a few months I have been called in on two different jobs to explain the spalling of brickwork. The reasons were identical. Now, if there had been some kind of a clearing house where anything like that was being published, the reasons known, the faulty details analyzed, it could have saved the second job. There is, I think, a crying need in the architectural profession, particularly now with the lawsuits that are sprung upon everybody at the slightest provocation, for case histories of this kind. It is a dangerous situation to have important information just filed in all of our offices and not being correlated. What could be done right now is to get a clever, qualified reporter to analyze the situation and start instituting a program for culling the facts in the most practical and efficient way.

I believe an effort should be made to start right now on a small scale. It is very nice to talk about getting the 'ten finest brains' I think Mr Swinburne mentioned, and put them on a research board tomorrow. It is impossible. Maybe after the program has been built up and proved its value. But right now I don't believe the finest brains could be attracted.

In my opinion, the buildings constitute the best basis for research in this field. For example now, we open up many buildings and set them on stilts. What will happen if a cold spell hits the open floor? Are the forces generated sufficient to create cracks as the building above resists the contraction? We have full-scale research going on right now to show what happens and it is just a matter of tapping it. That doesn't take the finest brains. It takes brains, yes, it takes the skill of observation, it takes a particular kind of talent that can be

found maybe in a clever superintendent who came up the hard way. He can see what is happening and then have it analyzed by someone who is technically qualified.

This should have been done long ago. It could be organized on a subscription basis. Architects could send in a question: My building is cracking on the north side, what is the reason? After a thorough analysis of all the facts, including, if necessary, a field inspection, the answer is given to the questioner and a general report is circulated to the subscribers without identifying the building. Then we can at least do something of real value, use the money that is available--which requires a very small amount--and we can begin to cut down on the frightful repetition of mistakes now so prevalent.

Now, so far as education is concerned, I think what is needed is that the architect have the opportunity of looking more deeply into construction so that he is not relying entirely upon the engineer for structural answers, because the architect is the one that needs the over-all picture. He must know the various possibilities and general principles. Unless he has at least a feel of engineering principles he cannot inspire the engineer to accomplish the best result. The engineer is very often so bogged down in figures that the thoughts do not come as readily to him as to an architect--because thoughts and ideas fit better within an architect's framework of natural inclination and training.

As a means to such education, a testing laboratory could be engaged to test structural models to destruction; I might even suggest sound films so that one can hear the crash when the model gives up-- then circulate it among subscribers and have them gradually get a feel of what goes on within a structure. A clever cartoonist could show compression and tension so that you could see the difference, you feel it, so that we could take this whole mystery out of structures and get away from the handbooks, get away from formulas, and begin to live within the structure.

In every architectural office there are case histories of solutions to interesting problems from beginning to end that could be edited and circularized after they have been cleared and after they have the approval of someone that is willing to stand back of it so that the subscribers are not led astray.

THE BEHAVIOR OF THE ARCHITECT... PROCESS AND PRODUCT.

Albert H. Hastorf, Professor of Psychology, Dartmouth College

After completing the usual ritualistic-like series of behaviors that I, and I assume some of you may also, employ to delay getting down to writing a paper, I found myself in the position of trying to sort out an impossible number of ideas. I felt as if I was in an analogous position to William James' most apt description of the world of the infant, 'a blooming, buzzing confusion'. There was a little too much sensory input and not quite enough organization. I have made a partial attempt to induce some order by, as the title indicates, making a distinction between the process of the creative act and the result of that act or set of acts, the product or the design itself. Like most distinctions that we make in order to simplify our world, it tends to collapse under the pressure of careful scrutiny. Be that as it may, it made me feel a

little better, at least temporarily. It does seem to me that there are a number of psychological issues related to the process of the design act; I would include here such problems as issues relating to the selection and training of architects, and orientation toward and the use of empirical research in solving design questions, and some aspects of architect-client communication problems. A smaller, but still significant set of problems, exist following the completion of the design. Certainly all sorts of architect-client interactions still must occur.

In thinking about some of the problems involved, a number of issues have arisen in my mind that seemed to be salient enough that a brief mention of them might help clear the air before going on to some more specific questions. I shall mention them so briefly that they may have an aura of simple mindedness about them, and I doubt very much if any of them have any answers at least in the general way I shall mention them. They reappeared enough that they at least ought to be mentioned.

(1) What should the architect of the future know? I mention this because I found it all too easy to solve some of the problems by concluding that the ideal architect should really have a Ph.D in Psychology. More than that, he really ought to be a specialist in experimental, social and personality psychology. Intelligent psychologists don't even claim that amount of sophistication. Be that as it may, let me urge that we keep clearly in mind the distinction between researchable problems of a psychological nature that have a bearing on the practice of architecture and the equally important question of what sort of sophistication, in terms of existing psychological information, architects might be urged to become acquainted with. For example, the argument that architects would find it very useful to learn something about interviewing techniques is quite a different bill of goods from proposing a research program concerning the effect on the final design of differing types of architect-client interactions.

A final comment on this point. I am strongly convinced that meaningful research problems dealing with the psychological aspects of architectural practice are only going to emerge from intensive discussions between architects and psychologists. This means that some architects must gain enough sophistication concerning psychological research methods and results so that these discussions can be productive. Need I add that any psychologist interested in this area of research must acquaint himself, at least to some extent, with the problems faced by the architect.

(2) What shall we mean by basic research? I do not think it is worth our while to try and answer this question. I mention it explicitly to try and warn against getting entangled in the verbal morass of trying to answer it. Consider the problem of the creative process in architectural design. Do we study the creative process itself as a general and not specifically architectural problem or, do we need to do specific (and supposedly applied) studies of creativity on the part of architects? It is a very tenuous dividing line between these two types of studies; both types should go on and I urge that we not worry about labeling them.

(3) At what level of generality should questions be raised? I fear that I cannot be as precise as I would like to be in reference to this question not only because of the nature of the question but also because my own thinking may not be entirely clear.

First of all, we can be prone to make questions too global. Asking such a question as, 'can psychological studies of space perception lead to the more effective design of building interiors?' leads, I think to the answer, 'yes, but'. The 'but' is important because now one must start specifying the problem down to some workable level. It has often been said that the most inclusive law in all science is the principle that things change. A good principle but so general to be of so little help. The importance of specifying questions at a level where an empirical answer is possible is the basic reason why the psychologist, even given certain knowledge about how the human organism functions (in terms of perceiving, learning, etc.) still cannot come up with any rules about how to design a building. My own feeling is that considerable specificity must exist before it is feasible to try and answer it in terms of empirical data. This issue of the importance of carefully specifying questions can be illustrated from the area of visual perception. My own bias is one of considerable doubt whether psychologists can specify any laws of 'good form' (Gestalt psychologists to the contrary). A functional approach to visual perception would imply that the characteristics of the people viewing the form and nature of the activities involving the form play an important role in determining the perception of that form.

(4) What about the relation of science and art? This question is raised with the hope of preventing rather than provoking argumentation. I can see no conflict between science and art because they are generically very similar. To put it all too simply, human experience (knowledge) is a function of the perceptual process and I can see no way in which the perceptual processes of the artist and scientist differ. The oft mentioned concept of objectivity really applies to the fact that science can so specify conditions that the same study can be repeated with the same results. Objectivity is a phenomenon that results from the methods of observing a phenomenon; it does not reside in the observer qua observer. The scientist is interested in specifying the conditions under which certain experiences occur by making those conditions as explicit as possible. The experience (or the creation) of the artist does not have to meet the same sort of repeated verifications by the observers. My hope is that the artist can make use of certain knowledge the scientist has gained and thus increase the effectiveness of his own creations.

(5) What about the question of values, in the sense of the good? I would guess there is no issue that is filled with more pitfalls and perhaps pratfalls than this one. I raise it because there seems to be a strong tendency to assume that people from some other discipline can answer such questions. Somehow, it seems that if the physicists could only talk in plain English, they could tell us what the world was really like. Or, if the psychologist only gave up that odd language system he uses, he could really tell us what is psychologically good for man. The obvious point is that the psychologist cannot answer such a general question as 'is this design psychologically good for man?' The statement leaves the question of 'good' undefined. I do happen to feel that, if considerable care is taken with the preciseness of the question, some questions of this sort may be explored in terms of the effectiveness of human functioning -- but again we must specify just what functions one wants to maximize.

Another aspect of this question is of great concern relative to the architect. It relates to how the architect might make use of information that could be provided by some of the disciplines represented here. The architect or planner might ask, let us say, the sociologist and the economist as to what predictions they can make to what the pattern of suburban living will be like fifty years from now. The goal being to design homes and communities that will 'be good' or functional for that pattern of living. The predictive capacity of those disciplines would serve to assist in the design process. However, we would be remiss if we neglected the fact that building and community designs affect the behavior of the people who live in and use them. Rather than stressing how science can help present designs fit future needs, we should keep in mind that present designs can serve to shape the pattern of future living and working.

This, of course, means that issues concerned with "what ought to be" can never be truly avoided by the architect or planner. Science cannot answer these questions, but it may well provide information that may make the guesses more educated.

Let me now turn to the behavior of the architect and try to raise some researchable issues from the standpoint of the psychologist. I find that the majority of these problems are most fitting under the category of process; on occasion a problem will be more meaningful under the category of product in terms of what happens after the original design process has been completed. My assumption is that the primary responsibility of this paper is to point to problems rather than to explore them in depth. I trust that the discussants of this paper will concentrate their efforts on exploring some of the problems in depth and that general group discussion will focus on some of these.

Training

A considerable amount of time, effort and money goes into the training of architects. I am certain that most people involved in this training (both students and staff) have some very strong convictions about that training. Assuming that teachers of architecture are like other teachers, these convictions will be either that their training is pretty close to ideal and shouldn't be changed, or that the present program is awful and the whole thing ought to be junked. Unfortunately, strong opinions of this sort are most prone to exist in the absence of any reliable information. Without getting involved in any specific suggestions as to what sort of curriculum changes might be tried, it is important to stress the need for a careful evaluation of these changes in relation to what had been done prior to them. We are a little too prone to be proud of and excited about our new curriculum ideas and assume that they are, by definition, successful. A careful look is sometimes threatening but pretty necessary.

The same general remarks can be directed to the problem of aptitude and interest tests used for the selection of students. As the training gets expensive, it becomes more reasonable to spend the money to try and select more trainable students. The crucial problem here, and also to some extent with the curriculum problem, is that of the criteria for success. One can escape from the question temporarily by saying that all you want to do is get a test that will predict grades in architecture school. This just avoids the crucial question of the relation between

grades in architectural school and later productivity as an architect. Do we know if there is any relation between these two bits of behavior? Is there any degree of consensus as to what we shall mean by 'later productivity'? There is always the financial criterion but I would hope that more meaningful ones could be developed. Any research of the kind I have mentioned must ultimately depend on some set of criteria relating to productivity, creativity or some synonym for these concepts. Let me add that the introduction of any courses in social science, interviewing techniques or visual space perception all entail the same problem. The statement that 'it will make them more effective' requires some definition of effective.

A final problem under this general heading, a considerable amount of psychological research is now being done on creativity per se. This research has delved into problems such as the abilities that go with it, life-history correlates of it and the role of the working situation. On the assumption that architects might be able to agree on some definition of the creative design, the problem could be approached in the same way. A series of studies have recently been published that took a careful look at outstanding scientists. Where did they come from, where did they train and how did they behave on certain psychological tests?

In relation to the question of training, I have been rather tempted with the type of systems analysis research that psychologists, mathematicians and engineers have become involved in. When a lot of data has to be processed so that certain decisions can be reached, are there more and less effective ways for such data to be processed? It strikes me that the architect is an individual who is in the position of having to process a great deal of data and ultimately come up with a decision (a design). In what order does he obtain this data; in what order are the 'small' decisions made? It intrigues me to think about this process, especially as many of the 'small' decisions may well be irrevocable. My guess is that many architects feel somewhat overwhelmed with the amount of data they must obtain. As a result, too little time is spent on integrating it which is the real essence of making a design. There may be better ways of getting the data and there may be alternative and better ways of ordering the decisions that have to be reached. The teaching situation might be used as a 'laboratory' for comparing alternative ways of organizing the design process.

Designing

Psycho-physical aspects

Let me begin by pointing out that I shall avoid any suggestions concerning the teaching of the elements of space perception to architects; I think these issues belong in the preceding section. Psychologists know a good deal about visual space perception and there may be some general rules of value to the architect. The real issue is whether the psychologist may be able to get data that will help in the solution of specific design problems as they arise. For instance, when a design problem arises concerning an interior where a certain effect is desired, experimentation may be able to help solve such problems. The same would apply to the use of certain colors in the solution of design problems. It is possible to abstract some of the variables so that they can be experimentally manipulated. This type of research is expensive in that it

would be done to solve only one specific problem, however, some pilot experiments might be tried and in time it may be feasible to build up some classes of data that may be of some general use. The same set of propositions exist for analyses of color phenomena.

Physical arrangements and behavior

The work of Festinger and his co-workers has demonstrated that the manner in which dwelling units are arranged affects the types of social groups that develop. These experiments serve as a model for a whole class of like phenomena. Given a desired structure of a working group, what physical arrangements best promote it? Assuming a certain pattern of living, how can we promote it by the design of a structure?

Once again, we must stress that, to make a problem answerable, questions must be phrased quite specifically. For example, in the process of designing a hospital an architect is asked to design a ward for children with rheumatic heart disease. Given this problem, the psychologist might well be able to make suggestions and, what is more important, obtain data that would enhance the possibility that children in this ward would be content with immobility (a state children do not normally enjoy). Research is now being done along this line in relation to elderly people and the special physical arrangements that may enhance their enjoyment of life. The design of mental hospitals is also finally getting some badly needed attention.

Assuming that the designer can specify what a certain situation demands, I am certain that the psychologist can gather data that will be of real help in promoting certain types of behavior. Let me re-emphasize that some good hints can come out of existing knowledge but in many situations new data must be gathered for the special problem at hand. There are some handbooks of human engineering in print that will help on such straightforward questions as the amount of lighting required for certain types of work. However, most of the interesting questions that can be asked will need new experiments to answer them.

Architect-client interactions

This is an extraordinarily broad area of concern. It is also one in which many architects must wish there were some magic techniques for simplifying them. This is an area such as visual space perception where I am convinced that some training in interviewing, for example, would be of great help to the practicing architect. I gather we know next to nothing about why people select a certain architect, what they expect him to do and why they are either pleased or disappointed with the results of this contact. I am struck with the constant reference to problems of communication. Perhaps what may be needed are diagnostic studies aimed at defining what communication techniques are employed and where they appear to break down. Conversations with practicing architects certainly indicate a great concern here coupled with little diagnostic effectiveness. So little is known about what really goes on that what I have called diagnostic studies are certainly called for. I am quite sure that we don't even know the conditions that lead to a happy and productive relationship. It would not be too difficult to arrange an interview study that would be a start at understanding these problems.

Architect-architect interactions

I introduce this heading because I am so impressed with not only the amount of group practice that goes on in architecture but also with the amount of interdependence between the architect and specialists in some specific aspect of construction. I fear that we know all too little about these types of interaction problems. It always seems that someone feels threatened. Studies of the medical profession indicate that research can tend to pinpoint some of these issues and start us on the way to some solution.

Architect-society interactions

Many problems in this area verge on the domain of my sociological colleagues. My concern here is to point out that the architect of today faces a series of problems that entail his relation to the 'public'. What is the 'public's' image of the architect; what do they expect of him? What is the public's understanding and reaction to such techniques as open planning? What is the architect's image of his own professional role? What are the conflicts that he experiences -- how much concern has he with art vs. market place issues? These are all questions that can be probed, yet we know so little about them. Many of these are problems that arise after the completion of the design; many of us have heard architects complain about having to 'sell the public' on the uses of their designs.

A final question concerns the educational role, and I might say responsibility, of the architect. It is not a bad guess to say that the public is generally unaware of contemporary developments in the design of living and working structures. People are bound to be accepting of what is as long as they are unaware of what might be. It would be profitable to learn some things about the public's present state of sophistication and then about effective ways of changing it. Professional groups in this culture have been all too hesitant to try and present the issues as they see them to the public. Someone usually raises the ghost of unprofessional conduct; on the other hand, there is such a thing as professional responsibility.

It is very apparent that I have done little but briefly mention a few of the aspects of the behavior of the architect that appear to be of psychological interest. Let me conclude by saying that I hope this paper will serve as a starting point for discussion (the intent was no more than that). I am convinced that psychological sophistication and research techniques can be of real help. Science is not an automatic or magic helper. Asking the right questions takes time, and getting answers takes time. I am quite certain that science can help and that the cooperative efforts that will grow out of this conference will be fruitful.

. . . DISCUSSION OF DR HASTORF'S PAPER ON PSYCHOLOGY

William H. Ittelson, Professor of Psychology, Brooklyn College, New York

We are all entirely too friendly and I think that we aren't going to get any really exciting ideas coming until we disagree with each other a little bit.

The sharp distinction of fields and the labeling and setting apart of one field from another I believe does us a disservice. I am very skeptical of approaches that set up disciplines and then have these disciplines interact with each other. The important problems don't fit themselves into nice little disciplinary categories--important contributions can be made by intelligent people regardless of what labels happen to be on them.

One conclusion in which I believe very deeply is that one cannot plan research. The attempt to blueprint in advance a program of research is necessarily doomed either to failure or to a very limited and perhaps sterile output. So I would hope that we are not trying to plan a research program and I am pleased to see that that has not been the trend of discussion so far. I'm not sure how one does stimulate research in psychology or in any other field but I am sure it isn't by planning it in advance.

Unfortunately there is great social pressure today for planned research and this is one of the pitfalls to watch out for. Research is costly and people who control funds quite correctly want to know what it is they are buying with their money. Therefore there has been a trend to support such things as team research and project research. If you want to get research money today it seems quite clear that the way to do it is to set up a team or a project, or if you're really clever, do both.

I hope we are not going to go off in this direction. A team is by definition a group of people who have agreed to agree. If they don't agree with each other, quite clearly it ceases to be a team. And yet research is by definition the product of someone who disagrees. It is the deviant individual, the individual that everyone agrees is wrong who turns out in the long run to be right. All wrong people aren't right but I think all right people are wrong.

People who agree to agree are not going to get very far in research. Similarly with project research--in my own field of psychology this is a very popular thing today and vast amounts of money are available for project research. It is a very interesting phenomenon. It is a program in which the researchers have already decided in advance what they are going to find, then they get money to find it and woe betide them if they don't. So, of course, they do.

A distinction has been made between process and product, between the creative design function and the hardware or technique aspect. A distinction, if you will, between research on what to do and research on how to go about doing it. I believe this to be a false distinction. These two are so closely interwoven that it is impossible to separate them. You can't decide on what you are going to do until you know the limitations of how to go about doing it, and you certainly can't go around the other way.

So this sharp distinction which has been drawn, perhaps implicitly in the title of Dr Hastorf's paper, is one that I would argue against. The paper carefully and explicitly outlines many, many areas in this total process where the psychologist can contribute. One of them is the question of finding whether the difference makes a difference--that is, comparison of alternative plans or alternative products. The architect cannot be condemned

severely for neglecting this area because the difference that an architectural structure makes is a sociological and psychological one. Therefore it seems to me that only when the sociologists and psychologists and people in related fields either put up or shut up can we find out if it makes a difference.

We have, I think, not only in the structural aspect but also in psychological and sociological aspects, a vast laboratory of already completed structures for study. All we need to know is how to go about doing it.

This is a particular interest of mine right now as I am involved in what I suppose is architectural research although I don't see it in any of the broad lists of projects distributed to us. It is to find out whether physical design of a psychiatric ward makes any difference in whether the patients get well or not. This is basically an architectural problem. Does it really make any difference, and if it does, how can we find out and how can we help the architect design a ward which will in fact have therapeutic potential?

This problem is very specific, an applied one, if you will, and brings me to another point with which I agree very heartily and that is the danger and difficulty and futility of distinguishing between basic and applied research. One can't conduct this kind of research without having a very broad theoretical background.

We have talked about contributing psychological knowledge to the architect. This knowledge can come in at least two ways. One has to do with studying the actual process which the architect or any other creative individual goes through. Decision making, evaluation, integration of vast amounts of information--it's all been mentioned--we can study these as a psychological and a sociological problem. We can also provide content for that process, that is, we can provide psychological knowledge that the architect can use. This distinction is made in the paper and I think it is a very important one.

We can probably contribute to both of these areas.

I was struck, in reading Dr Hastorf's paper and listening to other papers, by the emphasis on the time problem which the architect faces. From what I gather the architect is building on a past which apparently nobody likes, he is building for a future which no one in the world can predict and he is building in a present which is so transitory as to be almost irrelevant. If all this is true then it is indeed an unpleasant situation.

This is a problem which we can deal with in sociological and psychological terms. My own bias is that we will find the direction to look in an emphasis on the present. The architect or anybody else who builds for the future or constructs on the past is missing the boat. We are living in the present, we build for the present. There is a direct analogy here in architectural practice to psychotherapeutic practice in which the emphasis more and more has been on the analysis of the present immediate situation, the importance of the immediate situation. Here is a kind of broad psycho-sociological problem for basic understanding and on which further research can be done that can contribute to the security and safety and knowlege with which the architect approaches his particular problem.

Stephen A Richardson, Assistant Director, Association for the Aid of Crippled Children, New York

I looked at the list of labels announcing the background of the speakers and did not see one for philanthropoid. At present I am as much a philanthropoid as a social scientist because I am working in a foundation that supports medical and social research. First I want to disagree with Dr Ittelson about his stereotype of research projects being written up on the basis of knowing the answers before you get the funds--and also the tendency to assume one should inflate them into a very large project.

I think that the foundations are to blame for this stereotype. I think they have created this monster of project research with all the problems associated with it but now there is a good deal of soul-searching going on. Foundations are realizing there are many different ways in which research can be presented and assessed. So I don't think that we want to assume that to get grants anywhere we shall have to do it in the manner which has become considered almost a requirement by many people writing proposals. There is much more latitude now for proposals in which you can ask for funds for the development of ideas, for funds with which you can ask people to come together as in this conference.

I would like to talk at a down-to-earth level about the architect-client relationship, because this is something that has appeared in different shapes and forms in many of these papers.

There is now a considerable body of literature and thinking in the social sciences on how to establish and maintain cooperation with people from whom you wish to get information, generally for the purpose of getting data for research purposes. The architect clearly is in a comparable position although the conditions and characteristics differ. One way of determining how broadly a body of knowledge applies is to move it across to another area to see how well it fits. This is one way in which we can enrich our knowledge.

Establishing and maintaining cooperative relations with the client is obviously a matter of deep concern. For a long time in the literature on interviewing there was a quite explicit assumption that the more friendly the interviewer was with the person from whom he is trying to get information, the greater the likelihood that he would get large quantities of information, that its quality would be high and the accuracy, which would be an important factor, would be greatly increased.

This approach has come under question and we are now beginning to recognize that there are certain types of interpersonal relationships and certain types of needs on the side of the interviewer--in this case the architect--and on the side of the informant--in this case the client. A number of authors have suggested that there are two types of orientation which the interviewer may have. One has been called the 'task-oriented interviewer', who sticks very much to a careful delineation of the topics, the exchange of ideas, and the content of the interview. There is another type of interviewer who has been called the 'socially-oriented interviewer', who gets also

great pleasure from the social give-and-take involved in the interview, and who, while certainly involved in getting information, enjoys the very process of human interaction and may focus on this beyond the degree required for collection of information.

It is also recognized that the different kinds of people from whom one obtains information have varying needs. Again you can use this distinction between the task-oriented informant, the person who is interested in ideas, and the person who regards any interpersonal relationship as much from the social point of view as from that of task-orientation.

There are now some findings which indicate that friendliness is not a simple way of getting needed information. For best results one must first determine the needs of the informant, in this case the client, in order to move towards these needs but not necessarily wholly meet them. So that for a client who is trying to obtain a very broad, friendly relationship on a social basis it may not necessarily be advisable to comply with these wishes.

On the content of the interview--what are the types of information which the architect needs in order to do his job? Here I would be very much interested in the extent to which independent architects would reach consensus on what are the categories of information needed before they can design a structure for the client. Is there an optimum sequence with which to obtain the information? And also particularly, what are the social factors which the architect feels are pertinent in the design function? Most of the relationships reported in the literature have tended to deal with the architect who is dealing with the individual client who can afford a fairly expensive house and therefore the fee is of sufficient size to enable the architect to spend quite a lot of time in the development of that design. However, there is also a large area of architecture which deals not with one individual but with an organization or a corporate body. Here it seems to me that the architect's task is a very much more difficult one. How does he get the information in terms of organizational needs?

At this point I would like to quarrel slightly with Dr Hastorf, who assumes that there is a certain pattern of living or a certain structure of a working group, and then moves on from there in his discussion. It seems to me a very crucial and difficult problem that people within an organization are often only vaguely familiar with the total needs of their organization and there is often a lack of communication because both architect and client may assume a lot of the other. I think that the person in an organization who goes to the architect assumes that the architect has more knowledge than in fact he has about the social functioning of the organization--whereas the architect assumes that the client has much more information than he actually possesses. There is somewhat of a vacuum here which has led in some cases to unhappy results.

Here is a place for research where the architect in collaboration with the social scientist might be able to develop criteria for any organization to consider in terms of its social needs in developing information for the architect to use in planning.

There are other barriers of communication between architect and client. In most cases when the architect can afford to spend a lot of time with his client there is also the tendency in dealing with a person with similar background to use a similar

idiom, similar language, so that communication can be fairly adequate.

On the other hand, in the design of low-income housing, federally-supported slum clearance, to what extent does the architect know the pattern of living of the people? He is not in a position, in terms of his work and his role at the moment, to get very close to these people and to talk with them. One research possibility would be to look at the type of communication barriers between architect and client and to make funds available for better mutual understanding and interchange of information in areas where the architect has heretofore, owing to the nature of his role, been unable to get close contact with his client. I think that the work of Glenn Beyer and his Cornell group has been a very interesting example of this type of thing and I think we could do with a lot more of that type of research.

One essential function of research is that of follow-up to determine how satisfactory any structure is. With the present role of the architect this is frequently not possible in terms of his relationship with the client. This is especially true in dealing with organizations rather than with individuals and if one looks at clinical research in medicine the follow-up is an essential element in determining effectiveness of any work.

ARCHITECTURAL RESEARCH FROM A SOCIOLOGICAL PERSPECTIVE

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Architecture as a profession and architects as professionals clearly assume tremendous responsibilities. To meet these responsibilities in a mature manner appropriate to a major and distinctive profession, the practising architect deserves to be provided with the best possible accumulated and tested knowledge. Adding to this body of knowledge and systematically disseminating this knowledge are provinces of research.

It is the thesis of this paper that the architecture profession needs to develop a keen sense of research-mindedness. This should be brought about as rapidly and thoroughly as the profession can convince itself of this need and organize to bring about the required changes. While suggestions as to such changes may come from outside, the major moves must inevitably be generated within the profession. In view of this, my paper has been developed so as to deal less with what sociologists are or might contribute -- important as such contribution might be -- and much more with certain 'basic' directions which architects or architectural researchers may themselves be encouraged to explore.

I realize that I could readily be suspected from at least two directions: from sociology, in which I had my original training, for slighting sociological contributions; and from architecture for having the effrontery, even though not an architect, to suggest to architects what they should be doing! By way of some explanation (and perhaps self-defense), I have come strongly to identify with the city planning

profession and have been a member of a departmental faculty engaged in educating city planners to be. For the past three and a half years, I have also served part-time on the faculty of the College of Architecture, University of California. I have also served as chairman of the College's faculty Research Committee. During this period eleven different other faculty members, mainly architects, have served as committee members.

Dean Wurster has enthusiastically supported our efforts and been patient with our rather slow pace. This Committee has provided a continuing seminar for all of us, and I am greatly indebted to other members for such thoughts as I may be deliberately or unwittingly drawing from them. A subcommittee, at work for the past year, has completed a policy statement, which has now secured full faculty approval.[1] The responsibility for the present paper is, however, my own and I have sought to stress aspects of needed research that appear to be particularly justified from a sociological viewpoint.

This paper will be divided into three sections. The first will seek to spell out, in a rudimentary way, selected major interests of sociology as an academic field, but without bringing these to bear on architectural questions. The second will suggest some rather general reactions as to the possibilities for basic research related to architecture. And the final section will propose three subdivisions of potential architectural research that might benefit from collaborative work by architectural researchers and sociologists.

I

Sociology, as a field, studies the social environment within which people live. This environment is in may ways directly associated with the various other individuals with whom any one person deals; other people are highly important ingredients of any one man's environment. But this environment also involves a structural or organizational aspect that, while including people as actors, may be studied at a level that conceives of the positions or niches ('social roles' in sociological parlance) that people fill rather than the people per se. Further, this social environment carries with it various expectations or norms as to how persons filling the various social roles will perform. The whole great web of expectations for a people -- as to what their outlook on life is to be, what they are to be motivated toward, and what means they shall employ -- we term culture. In sum, the sociologist conceives of the social environment as embracing persons, social organization, and culture.

Sociology, by now a sort of holding company of diverse interests, in turn breaks down into many subinterests.[2] Perhaps the heart of sociology lies in the study of social organization: how effort is divided among persons so that complex tasks may be carried out and how diverse and specialized efforts are fused into a single ongoing activity system. This includes the study of various major institutional segments, such as the family, government, business organization, religion, education, etc. It includes the study of formal organization, bureaucracy, and the place of informal groups in large, formal organizations. In the past decade or so there has been a considerable run of interest in studying the small group as a particular form of social organization.

Another major interest of sociology, shading into and sharing the attention of social psychology, is the relation between

individual behavior and the individual's social environment. Here the concern is more for the ways in which and the degrees to which the social environment modifies or influences individual behavior. Also to be investigated is the question of the role of the individual in altering or affecting the social environment, as in leadership, social change, etc.

An important area of sociological interest, yet one that in various ways is extremely difficult to study, is that of values. Social values are shared assumptions or convictions as to what is to be preferred or to be conceived as right. Values are conceived as comprising an essential part of our culture. How values come to be and how they are altered, and how they relate to various aspects of social organization are important questions. Social anthropology has historically dealt with this phenomenon of values and shares research interests with sociology.

Two final areas of sociological interest are population and human ecology. The first of these focuses on people as discrete, statistical units whose numbers, increase or decrease, and movement are susceptible of quantitative study. Human ecology particularly studies the adaptation of a people's social organization to the physical environment. This subfield is concerned with the interrelations between a people's functional organization, their technology, and the functional and spatial patterns of their communities. This latter interest merges into a related interest by geographers in human settlement patterns.

The central theme about which sociologists are in substantial agreement is the relatively great importance of the group factor in human life. This provides an approach which supplements that of psychology, that as a field tends to focus on the individual as the primary unit for study. Psychology and the popular lay pastime of psychologizing involve a relatively greater degree of interest in the physio-psychological mechanism of the individual. The sociologist, on the other hand, is concerned with the social environment as something to be studied and understood in its own right, at its own level of abstraction, and as an important intervening factor in mediating human reactions to the physical environment and to other individuals.

Sociology has long been rather differentiated as between those who have insisted on measurable, quantitative sources of empirical data and those who have held that the phenomena most deserving of study might not be readily or fruitfully susceptible to quantitative methodological approaches. This division between 'hard-data' and alternative approaches is considerable. (As I understand the policy of the National Science Foundation for example, the 'hard-data' approaches in sociology have been judged to be more directly eligible for certain categories of the Foundation's financial support.)

II

It is generally recognized that architecture, unlike such professions as medicine or engineering, has not been a research-minded field. If we may accept for purposes of this paper, at least, the definition of architectural research to which our faculty Research Committee agreed, as that inquiry which 'seeks systematically and deliberately to add to the body of knowledge and conceptual approaches through which architects may gain greater understanding and from which they may draw with benefit in the course of their practice', then it seems evident that the architecture

profession has not applied itself wholeheartedly to this as a distinctive task. And if we introduce even stricter insistence on the use of scientific research as a means of formulating and testing general propositions as a part of a body of theory, the gap between architecture and engineering, for example, seems even more pronounced.

Four propositions will be developed in the remainder of this section:

1. Architecture as a professional field will greatly benefit by openly promoting systematic research.

2. The architectural research that will prove to be the most basic is that which feeds into and helps to test architectural theory.

3. While scientific methods of conducting research should be introduced in architectural research where applicable, there are cogent reasons why some aspects of architectural research should not be expected to conform to the tenets of academically respectable scientific research.

4. In general, architects must learn to take advantage of their own interests in varying their design solutions to establish comparative analytic studies of the results of that variation.

The benefits of promoting architectural research. Research, particularly basic research operating at its best, connotes exploration. Research to be important should explore potentially important ideas. Characteristically, research focuses on concepts or relationships that have a general applicability to a given class of phenomena. Even though certain kinds of research (for example, reliance on case studies) may appear to be concerned in detail with the intricacies of particular situations, research generally seeks increased understanding of a generalizable sort. Hence, to gain this kind of understanding is another way of adding to our knowledge of what we may expect of certain phenomena under given conditions -- in advance of such a circumstance occurring. Granted great philosophic and statistical difficulties in the exact reasoning employed, we may state in general terms that knowledge developed through careful research carries an element of predictability such that we may know more about what is likely to happen than we would have had we not carried out the research. By this token, we may expect that effectively designed architectural research should contribute to the generalizable knowledge upon which the architect may draw.

Research promotes intellectual rigor and healthy skepticism. One of the greatest challenges facing the researcher, and one which he must be trained to meet, is to achieve a clear formulation of just what his problem is. He should be able to cut through spurious relationships and to get to the heart of those relationships that most deserve to be investigated. The researcher, at his best, persists in asking what we really know or how we know it. Urged on by his own curiosity, he should be able to exert leadership in exploring whether ideas will stand up under test. This should encourage architecture as a profession to be more readily self-critical, hence gaining an understanding of weak points of those chains of reasoning on which the architect may wish to rely -- in advance of subsequent criticism from outside the profession.

We should be careful not to promise too

much in the name of research. What we might term 'researchism' can be as unfortunate as 'scientism'. By 'researchism' I mean the uncritical notion that all we need is research and somehow we can then solve any problem. Research should not be expected to solve complex problems at one fell swoop. Many of the problems of a clinical nature faced by the practicing architect contain so many variables and call for such a great sense of judgment that they are not reduceable to clear, researchable terms. As we shall develop shortly, research can never be a substitute for the clear determination of goals or ends. Research will in few if any cases lead to the brilliant design solution! In many cases research will merely provide a greater understanding of reasonable limits of choice and will thus prevent serious errors where the designer might otherwise be tempted to go beyond these reasonable limits.

Research to be most helpful to architects should ultimately lead to better choices among certain alternative approaches open to the practicing architect. The research elements in the profession (or within the individual architect) should constantly be asking questions such as these: On what basis do you select this alternative rather than that one? How much difference would it make if you used alternative A, alternative B or alternative C? What is the assurance that the use of concept X will bring about Y reactions?

A sensitivity to the spirit and methodology of research seeking generalizable propositions should also feed into the quality of analysis employed by practicing architects in the course of their own practice. It should feed into the quality of analysis that might well be expected from architectural students taking architectural design courses. I would definitely recommend exposure by students to research approaches relevant to architecture, not to make researchers out of them, but rather to imbue in them a respect for what can be expected from research, to equip them to ask intelligent questions of researchers, and to provide an attitudinal basis for allocating to research a sufficient portion of those resources available within the architecture profession so that architectural practice may be more adequately supported by knowledge.

Architectural research and architectural theory. Theory may be conceived as a body of interlocking propositions. In an academic field -- and this is our most common setting for theory -- theory is tantamount to a model or a construct dealing with a major range of phenomena such that, although the number of variables is characteristically deliberately reduced from the corresponding world of experience, this model can handle many possible relationships and changes with the derivable outcomes not inconsistent with empirical observations of experiential events. For academic purposes we seek a framework that provides certain qualities of understanding.

Each profession also needs to develop appropriate theory. Such theory, if we follow Ernest Greenwood's suggestion[3] (applied to the social welfare field, but applicable by analogy to other professional fields) that this takes the form of 'practice theory', provides a systematic rationale on the basis of which professionals may practice. Such theory has many of the characteristics of academic theory and is at no point inconsistent with relevant scientific theory. But it differs from academic theory because it incorporates certain assumptions as to the goals of professional action (such as

good health, a beautiful physical environment, etc.) and particularly focuses on propositions as to how such goals may best be reached.

The continuing formulation and refinement of what we may term architectural 'practice theory' would thus appear to be of central importance. It is this task, I submit, that should lie at the heart of architectural research. As Robert Merton already has suggested in his November 1957 memorandum[4], basic architectural research will cut across what are sometimes distinguished as pure and applied research. What is basic research for architecture involves a range of intellectual explorations which can best be tied together by the formulation of various chains of reasoning applicable in the course of architectural practice. While such reasoning can take various forms and may involve considerable complexity, we may suggest in an introductory vein that it must take into account (a) the values that are judged to be the goals of professional effort; (b) the ways that people use architectural structures and spaces; (c) how architectural spaces are created, perceived, and reacted to; (d) how structural systems work; (e) how materials work; and (f) how the architect is to select from among many alternatives in resolving his design solution.

This suggests that architects who also gain the requisite training and motivation to become specialists in architectural research have a distinctive responsibility for weaving together an understanding of architectural practice, the rudiments of theory formulation, and the potential contributions from many related fields. But if one focuses on the interplay between architectural research and architectural theory, then it becomes apparent that a series of research findings pieced together from peripheral fields, no matter how excellent by scientific canons, may not be maximally relevant to the practice of architecture. Certain concepts and relations, particularly those dealing with the creation and the use and preception of space such as the architect is responsible for, will stand out as under-researched by outside fields. Conversely, certain frames of reference or conceptural schema that satisfy requirements for theory building in other fields may be ill adapted to the distinctive kinds of classes of problems faced by architects. The only hope here is for the architects self-confidently to build their own central theoretical framework and to use this in judging the relevance of peripheral research findings.

Architectural research not necessarily scientific. The appropriate applicability and the limitations of scientific approaches to research should be understood, so that the development of basic architectural research may achieve an appropriate balance as between scientific and other approaches. We have already alluded to the idea that practice theory for a profession includes certain assumptions as to the goals of professional effort. While these may be recast or clarified in the light of scientific research, these goals reflect the values of the surrounding culture and the ideology of the profession. Hence, this component of architectural research, dealing with the goals of architectural design, is essentially ultra-scientific. It requires a sensitivity to what people need, what the profession interprets as its distinctive responsibilities, and what consensus-deriving mechanisms such as government conclude or proclaim.

Even beyond this identification of goals, we must recognize that architecture as a field has traditionally drawn heavily from related art fields and from the humanities.

If the most critical conceptual problems facing the architect have to do with the creation of space, the experimentation and the inflow of key and highly imaginative ideas as to space may come from various visual-art fields, such as painting and sculpture. This is not to say that it may not be important to seek to reformulate certain concepts into hypotheses for scientific examination. But the exploration of the ideas calls for approaches that may not rely on customary scientific methods.

Architecture should definitely be encouraged to retain its strong art ties and its traditionally humanistic orientation. Among other reasons, it is unrealistic that too great a swing in professional ideology toward science would be appropriate or healthy for a field with the rich historical heritage that characterizes architecture.

But architecture must also come to realize that its practitioners deserve more than 'rule-of-thumb' or 'seat-of-the-pants' operating concepts. A major profession should not trust to chance that the experience of previous building or of analogous sculpture is funded and systematically passed on. It should seek to develop a strong body of empirically based propositions that will throw convincing light on the question of how much difference it would make whether the design is handled this way, that way, or some other way. Architects deserve tested laws showing performance characteristics as various dimensions or factors are varied, such as are more prevalently developed in engineering.

Comparative analytic studies. The potentialities for combining the natural inclination of the designer to provide 'new solutions' and the interest of the scientist in comparative (and, if possible, experimental) research would seem promising indeed. A team effort is called for, such that the designer is actually encouraged to 'experiment' in the buildings for which he is responsible and, by prearrangement, trained researchers study selected aspects of how much difference this makes. But do we see much of this spirit of designer-researcher cooperation? Certainly it is not being reported, if it is occurring in the United States. Vernon DeMars has recounted the time he was responsible for designing a farm resettlement project and he deliberately used one plan of siting housing in the first half of the project and another in the second half, hoping that someone would want to study the differential impact of the two site plans. The research has never followed! True, collaborative study gets undertaken in some foreign countries, notably Sweden, but American architects have not pursued this possibility.

In general, architects need to conduct methodological research (ie, research as to what research method to rely upon) as to how they can most effectively analyze alternative design possibilities. Architecture as a profession generally seems to be committed to suggesting a single design solution to the client. The standard and plausible explanation is that if two or more tentative solutions are offered, the client will inevitably say that he wants certain features from each and will tend to insist on them. This presumably plays the devil on the resolution of an ultimate solution, and the architect wants to avoid this. But the idea of presenting the single solution may leave it unclear, both to the client and to any outside observer, just what alternatives were studied and what were the relative merits or shortcomings of these alternatives.

In many cases the examination of

alternatives involves essentially economic analysis, in the sense that the relative benefits and costs of alternatives deserve to be appraised. A highway engineer will undoubtedly seek to explain what the differences are in both cost and performance as between different thicknesses or alternative mixes of concrete. The final solution, if rationally determined, can suggest a thickness and a mix that best balance the minimization of cost and the maximization of performance.

In the course of the intelligent analysis of alternatives there logically evolves a sense of model building (in the scientific theoretical sense, rather than a three-dimensional architectural model). That is, key conceptual variables or dimensions come to be hypothesized; ways of analyzing their interdependence in simplified or ideal form are then developed; and the study of alternatives in terms of limited-factor analysis is undertaken. Successive refinements could permit analytically superior models. In this endeavor architects could learn by analogy from various other fields which have already committed themselves to this kind of analysis.

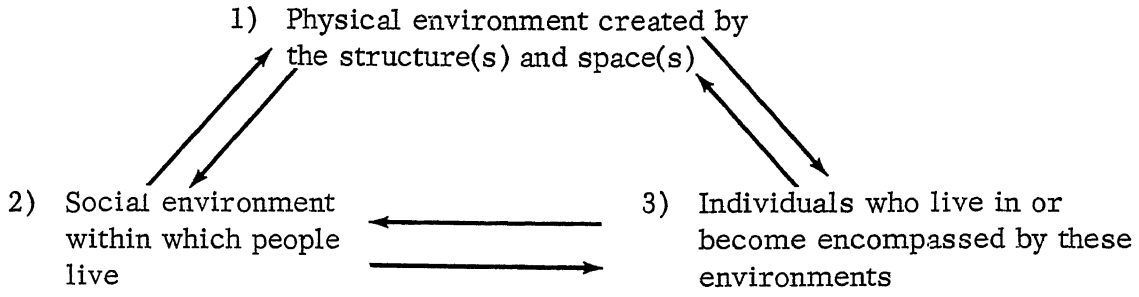
An important logical difficulty is the simultaneous handling of many variables. The simplest experimental comparisons tend to follow the pattern of holding almost all factors constant while deliberately manipulating only one variable or at the most a very few variables. And yet the architect must incorporate into his design dozens or hundreds of variables -- and all at once. It is important to stress the distinction between the experimental analysis potentially available for the researcher and the design-decision process that must be relied upon by the practicing architect. As in any situation calling for accurate diagnosis, the human mind must be willing to serve as its own computer, capable as it is of taking complexities and subtleties into account so superbly. But appropriate comparative analysis can help the designer view certain alternatives in such a way as best to draw upon tested principles as to performance, behavior or reactions.

In sum, it would seem essential that architects develop a spirit of reliance on, and the methodological know-how to be capable of, systematic comparative analysis of design alternatives with which they are confronted.

III

'Commodity, firmness and delight' have long been recognized by architects as essential criteria that an architectural structure is expected to satisfy. These three terms also suggest equivalent major divisions of architectural practice theory: functional, structural and esthetic. From a sociological viewpoint, the first and third of these are of more direct concern than the second. Structural analysis, while crucial for architectural theory and practice, relies more on engineering and its supporting physical-science fields than on sociology or other social science disciplines.

The sociologist, focusing as he does on the nature of the social environment, naturally tends to stress the potential importance of the social environment as a kind of factor intervening in various ways between the physical environment created by the architectural structure and the persons accomodated by that environment. Diagrammatically, this interest may be expressed as:


1) Physical environment created by the structure(s) and space(s)
2) Social environment within which people live
3) Individuals who live in or become encompassed by these environments

For certain purposes it is sufficient to focus on 1, as in questions of structure and materials. From a physio-psychological viewpoint it may be most relevant to analyze the relations between 1 and 3. Thus the important study of climatic control or the examination of many perception considerations. The sociologist seeks to remind both the architect and other researchers that there are important chains of relations from 1 via 2 to 3 or from 3 influenced by 2 to 1. For example, the social groupings that may be deliberately or unwittingly encouraged by the architectural spaces in turn have their own kinds of impacts on the participants. And the reactions of persons to the building may be considerably influenced by their subculture and by interaction with their peers or opinion leaders.

In the remainder of this paper, we shall limit ourselves to identifying and discussing three main research directions:

1. The social organization of the activity unit to be accomodated.

2. Social factors related to perceptual and esthetic reactions to architecture.

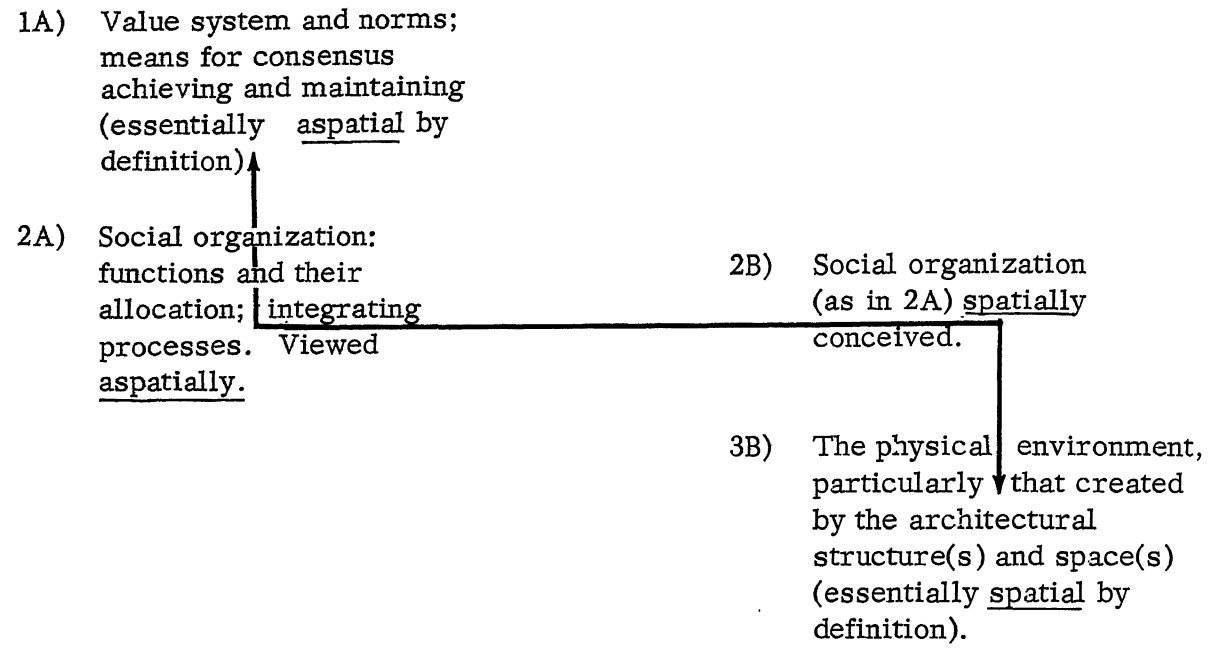
3. The sociology of the architecture profession.

Each of these in its own way provides a very relevant framework within which a wide range of factors bearing on architectural design decisions may be understandingly approached. Each facilitates a very broad cultural and organizational context being taken into account and being brought to bear on architectural design problems.

1. The social organization of the activity unit to be accommodated. This first subsection proposes that major research effort be expended such that architects may gain the best possible understanding of how the activity units for which they are called upon to design architectural structures are organized and function. While this phase of architectural research and theory development would inevitably involve a certain sense of unique orientation as best relates the study of organization to the primary interest of the architect in creating the best possible housing and space arrangement and quality, it should also take into account and be congruent with the many-faceted attacks on organization and organization theory developed by sociologists and other social scientists.

While the task of the practicing architect is largely clinical, in accurately diagnosing the configuration of features uniquely characterizing each situation, the challenge confronting the architectural theorist and researcher is to identify those classes or categories that most appropriately designate kinds of patterns, relationships,

or functions about which generalizations may be developed and tested. In very brief form, we shall suggest the rudiments of a conceptual framework. This could serve as a setting within which the more specific research efforts may be viewed with some sense of perspective. The following diagram presents the major elements of the proposed framework:[5]


1A) Value system and norms; means for consensus achieving and maintaining (essentially aspatial by definition)
2A) Social organization: functions and their allocation; integrating processes. Viewed aspatially.
2B) Social organization (as in 2A) spatially conceived.
3B) The physical environment, particularly that created by the architectural structure(s) and space(s) (essentially spatial by definition).

This suggests a major chain of reasoning, so to speak, that may be applied to any activity unit for which an architect may be called upon to design a structure. Whether the unit is a family, a business firm, a manufacturing corporation, an elementary school, or a recreation center -- these elements would seem to be relevant. This framework suggests various interlocking propositions that deserve to be hypothesized and subjected to empirical test. This or other frameworks and the propositions or principles evoked could provide a basis for one major aspect of architectural theory.

From a sociological perspective, the major focus might well be on 2A, the character of the social organization. For purposes of developing architectural theory it is essential to develop generalizable propositions that could apply, as relevant, to many specific organizational units. A sophisticated classification of kinds of organizational units, in terms of what are judged to be the architect's primary responsibilities, is called for. Also required is extensive methodological research aimed at equipping the practicing architect with the best possible analytic concepts and techniques. But more important, in our view, is the need for systematic examination of the fundamental relations between each of the steps 1A to 2A, 2A to 2B, and 2B to 3B.

The first relation, 1A to 2A, is particularly adapted to sociological investigation. It features the interplay between values and norms, on the one hand, and the functional organization of the activity unit in question, on the other. Presumably the functional organization is so formed that it will best facilitate (and not impede) the values

sought. The identification of alternatives regarding functional organization and analyses of their relative merits are important. Since the functional organization incorporates technology, it tends to be subject to greater change than are the values. This may result in cultural lag in which values may be out of phase with the organization. From an architectural designer's position, how are discrepancies as between the professed values and the functional organization of the unit to be handled?

The second step, from 2A to 2B, is a critical one for architecture, for it involves the important transition from aspatial to spatial.[6] It is with respect to this step that the architect should be in a strong position to provide professional advice to his client, and should be able to draw on relevant tested principles regarding this relation. Here the question is what difference it makes to the functioning of the organization to vary the spatial arrangement of that organization. Take as an example the question of how much difference it makes whether an organization is housed on one floor or on two or three floors. Or in the internal arrangement of an office building, how much difference would it make whether the heads of four departments are dispersed spatially so as to be at the center of their respective units or whether these four department heads are housed together in an executive suite as nearly adjacent to the four departments as possible? If a university building were being designed to accommodate several departments that together constituted a college unit (one of several such units within the larger university), how much difference would it make to put all the graduate-student spaces together, thus cutting across department lines, as against housing the graduate-student space separately within each department? The solutions to these and many other questions -- faced jointly by architect and client -- may vitally affect the subsequent functioning of the organizations in question. Is it not reasonable to assume that architecture as a profession should develop the best possible knowledge of the implications of spatial arrangement on functional organization?

The final step, from the spatial pattern of the social organization to the physical environment of the structure (2B to 3B), while of first-rate importance to the architect, may be less amenable to sociological inquiry. But even the constant reminder to the architect and to others that the organization or the activity system being accommodated is something separate from the architectural structure or shell is fundamental! The organization may be rather susceptible to change during any future period of time, and we may posit the notion of physical environmental lag (conceptually parallel to that of cultural lag, suggested earlier). This suggests that the shells of the structures, inevitably designed far in advance of the main lifetime of the activities to be accommodated by the structures, will tend to be relatively fixed and may impede organizational growth and change. What are the theoretical alternative ways by which structures may handle inevitable functional change? How well do loft-style structures, such as are now being used in the contemporary design of large office buildings, work over a long time period?

What has been suggested here, in summary, is that by a chain of reasoning we may move either way via the central concept of social organization as between the values or goals to be achieved and the physical design of the structure. This also places open emphasis on the transition from aspatial to spatial, which we are convinced may be conceptually dealt with most

profitably at the social organizational level. Putting the chain of reasoning in the 'S' shape encourages each of three steps to be taken one at a time: first, the transition from values to social organization, both aspatially viewed; second, the relation of aspatial to spatial, both at the organizational level; and third, the distinction and the relation between the social organization and the physical environment; but both in spatial terms.

2. Social factors related to perceptual and/or esthetic reactions to architecture. In this subsection I am recommending that research be undertaken to identify important features of the social climate within which the architect works and the future social climate in which the structure he is designing will enjoy its life. A major feature of such research would be to gain understanding of the way in which social values and other social forces impinge to influence how persons or groups will react to or evaluate the product of the architect's design.

Architecture as a profession has the very distinctive responsibility for producing lasting structures, which in turn define spaces, that come to provide an essential part of man's physical-visual environment. The structures, therefore, must not only work in the sense of accommodating the activities that will go on in or about them; they must stand the test of looking well. This immediately moves us not only into a perceptual field of inquiry but also into an esthetic sphere. For how does one judge whether the structure 'looks well'?

While we do not underestimate the importance of research on perception, we assume that this is in great measure a field most properly discussed by a psychologist. As phases of such research, we would merely suggest (a) research as to the effect of the social and cultural situation on an individual's perception and attitudes, and (b) studies of the social climate or segments of this climate that bear on reactions to architectural structures.

In either of these phases, and they are of course interrelated, there are clearly many parallels with other kinds of research: studies of popular culture, consumer behavior, cultural and attitudinal change, the role of those charged with intellectual or artistic leadership, etc. Some of these studies are concerned with the rather broad trends of social and intellectual history. Other relevant studies shade into research on the architecture profession. These will be discussed as Item 3 below.

Social psychological studies of how people perceive and react to architectural features--reactions to the exterior of structures, to the spaces created in the interior of these structures, etc. -- should take into account the group membership and the subcultural environment of each subject studied. Architects, like most professionals, tend to reflect not only attitudes induced by their own education and professional contacts but also an essentially middle-class outlook. How do persons from other social classes view architectural structures? Herbert Gans has reported some participant observational studies in a lower income, Italian area of Boston wherein the familial and interpersonal contacts that loom as the most important part of their environment and the character or style of housing would not seem to be very prominent in their minds.[7] This is in considerable contrast to the attitudes held by the middle-class family on the social make, for whom the house may be a very important symbol of status. Architectural

'pleasantness' often seems to be correlated with the most socially respectable areas of the large city.

A phenomenon that deserves greater study is that of tract residential building. Here an entrepreneur generally accepts a great responsibility for discerning what the prospective home buyer wants and what he can best offer them within the price ceiling or range at which he decides to operate. While some architects seem encouraged with the general rise in quality of such suburban housing during the past decade or two, and while in selected instances (Eichler homes in the Bay Area, for example) architects have had a strong impact, in general this mass production of single family homes has been beyond the control or even the direct interest of the architecture profession. What may be learned by research on owners' preferences and developers' interpretations of these preferences?

We lack systematic studies of how persons of backgrounds and social positions that could be meaningfully classified react to specific kinds of architecture. When significant architectural contributions appear, they tend to be illustrated and briefly discussed in various architectural magazines. But what do we ever know of more general reactions? What basis can we develop for forecasting the public reactions to a prospective building?

While we have considerable activity in the history of architecture, and historians serve as critics in interpreting the relation between trends in architectural style and social periods and forces, we do not have rigorous comparative and empirical study of the conditions under which certain kinds or styles of architecture have or have not gained popular acceptance or acclaim. This was dramatically illustrated to me by a recent research proposal developed by an architecture graduate student from Thailand, who became curious about the probability that contemporary architecture might be accepted for religious temples in his native country. This propelled us as a seminar to discuss how it was that new ideas gained favor or were resisted in a country such as his, and to what extent we would expect that reactions to architectural style would or would not follow the pattern of reactions to other kinds of innovations.

Some thoughtful intellectuals are questioning the effect of the large 'projects' -- apartment projects, large shopping centers, etc. -- toward which we have been having a great run.[8] While the large projects provide great possibilities for integrating functional requirements and introducing a unifying esthetic, they also run the danger of providing rather cold and even brutal effects as compared with the results of many years of more individualistic development. This becomes a major problem for civic or urban design: how do people react to various major alternative approaches? Are the values favoring newness and bigness so much a part of our American culture that the great architectural and engineering projects become symbols that are welcomed? To what extent do people want to hang on to the traditional? I was riding a bus the other day and was suddenly aghast that what I had always thought of as a lovely old Victorian house had just been torn down to make way for an apartment building. A lady behind me remarked to her friend: 'Isn't it a wonderful sign of progress when those old places can be replaced with nice new buildings?'

Clearly the architect needs more than facts as to how other persons react to various kinds of architecture. His practice theory must include a clear sense of his role as

a member of an elite that is charged with providing structures of good taste. Some clients, for whatever combination of reasons, seem to know this is what they want and are willing to pay for architectural services in order to achieve it. But what further responsibilities does the architect have on behalf of 'the public interest'? This requires a continuing search for consensus as to philosophy and deserves to be fed into architectural practice theory.

3. The sociology of the architecture profession. This final subsection suggests that a research spotlight be directed at architecture as a profession in order to show the influence of its profession subculture and its traditional approaches on the process by which design takes place and on the character of the product designed. This also fosters the examination of the play of many external forces on the profession and raises important questions as to the adaptability of the profession to changing needs or revised interpretations of needs.

The publication in 1954 of the two-volume The Architect at Mid-Century marked a singularly notable effort at self-examination on the part of the architecture profession. Continuing research is warranted. The challenge here is to hold mirrors up to architects so that they perceive themselves and their values and operating traditions more accurately. By focusing on the subculture, that, in effect, blankets the architecture field it is possible to identify the kinds of assumptions that architects most readily take for granted and which they themselves lose sight of because they seem so 'natural'. Research comparing architecture with other professions will demonstrate to architects the ways in which they are alike or different from these other fields.

One of the most important segments to be examined is architectural education. Just how is the novice trained? How does he become imbued with the attitudes that the professional is expected to hold? What are the relative places of the architectural school and the initial office experience in the young person's induction? What are the roles of the professional schools as they seek both to represent the architecture profession and also to adapt to the educational philosophies of their host universities?

How is research dealt with by the profession? What are the roles of architectural schools with respect to research? To what extent do the attitudes taken toward research by architectural school instructors become reflected in subsequent reactions by young professionals?

Deserving study are the relations between architecture as a profession and related professions -- engineering, landscape architecture, city planning, etc. This includes jurisdictional disputes and ideological differences. It includes patterns of collaboration.

Included, too, should be the study of professional organizations, particularly the place of the American Institute of Architects. How effective is the leadership developed through the national and the various sectional levels of this major organization? In what ways does the AIA assist the profession in adapting to changes? In resisting changes?

The study of how architects communicate with each other seems to be a particularly profitable area for study. It relates, incidentally, very meaningfully to the whole question of research-mindedness which we have been dealing with in previous sections

of this paper. If, as it appears to a participant observer, architects tend to communicate mostly through pictures of or visits to see the final products of their design, what assurance is there that the same major and generalizable ideas that may have been developed in the course of the building's design are being similarly communicated to all who see the building or pictures of the building? We take for granted that for communication via medical journals the researchers and occasionally practitioners collect similar classes of cases and report on the class (even though they may have relied on a sample of only 22 cases). But we seldom see classes of phenomena dealt with in quite this way in most architectural magazines.

Many architects have told me of the great reliance they must place on the sales representatives or manufacturers' literature for information about products they may be considering using. Do architects also work this way in finding out information about other aspects of problems facing them? To what extent do they rely on indexes and abstracts to research on performance characteristics, function-space relations, etc.? How intelligently are those information-cataloging services that are functioning used by members of the profession?

Two final suggestions relate to the organization of the architect's office and the nature of the relations between architect and client. As The Architect at Mid-Century suggested, there is an important question as to the correlation between architecture school training and the roles assumed by graduates of such schools as they work their way into medium or good sized offices. What array of functions and skills must be mobilized in addition to the role of key designer? In the interaction between architect (or his representatives) and client (and the various persons representing his organization) lie tremendously important considerations for study. What are the various kinds of relations that are likely (ranging, for example, from the very dominant architect to the very strong-willed client)?

* * * * * *

In this section I have limited my discussion to three proposed research directions. May I also remind the reader that a considerably broader classification of architectural research that an architectural school might consider undertaking or promoting is contained in the architectural research policy statement recently completed by the Research Committee, College of Architecture, University of California.[9] This will provide a more general perspective, rather than one that is deliberately sociological in its orientation.

Footnotes

[1]Research Committee, College of Architecture, University of California, 'Policy Statement on Architectural Research, College of Architecture, University of California,' December 1958. Mimeogr. The subcommittee comprised Sami Hassid, Chairman, and James Prestini.

[2]For a contemporary review of these subinterests, see Robert K Merton, Leonard Broom and Leonard S Cottrell (ed.), Sociology Today: Problems and Prospects (New York: Basic Books, 1959).

[3]Ernest Greenwood, 'Social Science and Social Work: a Theory of their Relationship.' The Social Service Review, 29 (March 1955), pp. 20-33. Reprinted under the title, 'Relationship of Science to the Practice Professions,' Journal of the American Institute of Planners, 24 (Fall 1958), pp. 223-232.

[4]Robert K Merton, 'Some preliminary notes on problems and prospects of Conference on Basic Research in Architecture, 'Memorandum to Walter E Campbell, Chairman, AIA Committee on Research, November 4, 1957. Mimeogr.

[5]I wish to express my indebtedness to the Resources for the Future, Inc., for a grant to the University of California which has made it possible for a small team of scholars, under Melvin Webber's chairmanship, to explore certain theoretical approaches to the spatial organization of metropolitan communities. The essentials of this diagram were developed in that project and will be reported in a forthcoming publication.

[6]It is possible that the term, 'aspatial', is not the best to use here. We do not want to say 'nonspatial', because we do not mean that the organization is not in space or does not have a spatial pattern. By 'aspatial' we mean the discussion of a phenomenon without even thinking of its space aspects. Walter Isard, for example, has demonstrated that the Anglo-Saxon intellectual stream of economic theory has been essentially aspatial, implicitly assuming that economic activity takes place at a single point in space. A rather different German approach sought to take space into account.

[7]Herbert Gans, 'The Human Side of Redevelopment and Relocation Planning', Journal of the American Institute of Planners, 25 (Feb. 1959), pp 15-25.

[8]See for example Nathan Glazer, 'Why City Planning is Obsolete', Architectural Forum, 109 (July 1958, pp 96-98, 160 f.; Jane Jacobs, 'Downtown is for People', in the Editors of Fortune, The Exploding Metropolis (New York: Doubleday, 1958), Ch. 6, pp. 157-184.

[9]See footnote 1 above.

. . . DISCUSSION OF DR FOLEY'S PAPER ON SOCIOLOGY

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Architecture Research and Social Values

The term 'values' has arisen many times in the background material sent to us and it has appeared on a number of occasions today. Dr.Foley's paper states: 'An important area of sociological interest, yet one that in various ways is extremely difficult to study, is that of values. Social values are shared assumptions or convictions as to what is to be preferred or to be conceived as right. Values are conceived as comprising an essential part of our culture. How values come to be and how they are altered and how they relate to various aspects of social organization are important questions'.

To be more explicit I will list some generic characteristics of values suggested by

a Cornell value-study group a few years ago. They said valuing is in some sense conceptual, it is more than pure sensation, emotion, impulse, reflex. The conceptual element may or may not be highly conscious or explicit. Values exist with widely varying degrees and kinds of awareness in individuals. Values are effectively charged. Values fall within the locus of interest or effect; they carry an emotional coefficient.

Although values have this effective dimension they are not identical with particular segmental needs of the organism. Specific physiological deprivations and gratifications may be relevant to a great many values but do not of themselves constitute value-phenomena.

Values are not the concrete goals of behavior but rather are aspects of those goals. Values appear as the criteria against which goals are chosen and as the implications which those goals have in the situation. Values as components in conduct-choices are directional; they seem to act as vectors that polarize impulse and action. Values may or may not be highly organized into systems. Some values are directly involved in the individual's existence as a self. Value is important; the quality of which we are speaking is not trivial or of slight concern. Values, as characteristic of groups or social systems first are widespread and permeate many activities; second, are tangibly supported, fostered, encouraged, rewarded, praised, emulated. Conversely, if violated, the effective social consensus supports censure, ridicule and punishment.

Next, they tend to endure through time. A rough hierarchy of values may be defined in some instances by observing which values are sacrificed in favor of other values.

* * * *

This description serves the purpose of providing a general frame of reference. It will be noted that the characteristics just described have not been purely sociological in character. In fact some were definitely psychological. However, for purposes of this paper it seems more desirable to discuss values in their total scope rather than confining discussion to one area alone.

Obviously, when this concept of values is applied to architecture some of the characteristics described above are more pertinent than others. For example, if values act as vectors which polarize action, they become highly important in this discussion. Some elaboration and some indication of how the term value differs from closely related terms will be helpful. A value differs from a preference inasmuch as a preference generally is based on an individual's range of experience and may not be justified on the basis of any commonly accepted standards or moral judgments. A value differs from an attitude inasmuch as an attitude may refer only to what is desired while a value is what is desirable. Both preferences and attitudes are likely to change more frequently than values; values tend to endure. It is not known by what process attitudes and preferences may become values.

The Cornell value-study group differentiated between values and goals by indicating values are not the concrete goals of behavior but rather are aspects of those goals. Values appear as the criteria against which goals are chosen and as implications which these goals have in the situation.

On the basis that values are related to

standards there is the element of 'ought' and 'should' in this concept. In other words, if a certain value is held in a given society, for example the value of freedom, the individual's actions will be approved or disapproved on the basis of where they fall on the continuum regarding that value. As long as individuals continue to have wishes and tend to appraise what they want, there is no escape from values entering in. Part of their importance in architecture, of course, rests in their relationship to motivation because, as indicated, they tend to establish the direction in which action is taken. However, here again, values should not be regarded as motivation per se, rather only one element. They are that element concerned with the standards but do not include other factors making up the total situation that actually creates motivation.

In other words, an individual's action is usually a compromise between values and other aspects of a situation. Although much remains to be learned concerning the complex linkage between values and motivation, it should be possible to use values in predicting behavior.

Two other important phases or aspects of values are important. The explicit aspect is that which is readily expressed or asserted; in other words it can usually be verbalized by the individual, probably because part of its nature is that he is likely to be highly conscious of it. The implicit aspect, on the other hand, must be inferred from an individual's behavior. Sometimes this is called the 'operative' aspect and the individual may not be conscious of its existence. Values themselves usually vary from explicit to implicit. No two individuals are likely to share precisely the same values.

Dominant values are those primary or outstanding values held by an individual. Using an analogy, dominant value orientation may be regarded as being held by a group. However, in a group the question arises as to how the majority members are able to enforce these dominant value orientations on the minority members. Festinger has some interesting comments on this in his book.

Our Cornell research has been somewhat in the vein of the clinical research referred to today and suggested by Merton. One of the first tasks in undertaking this exploration was to identify a list of values that were felt to have a relation to housing. Nine were selected: Family centrism - equality - physical health - economy - freedom - esthetics - prestige - mental health - and leisure.

It was because these particular values were selected on the basis of their reference to housing that family centrism, for example, appeared as one of the items. Many of the values, however, such as freedom, equality and status or prestige, are equally valid for architecture in general. Another study group working on the same problem undoubtedly would have come up with a somewhat different list but these nine items represented a starting point.

In an attempt to develop some empirical data on this complex subject, three field surveys involving interviews with over 3,000 individuals were undertaken, two in the urban areas of Buffalo and Binghamton, New York, and one in a central New York rural area. It was felt that samples of these three groups of populations would represent the variation necessary to test certain hypotheses concerning actual existence of these values.

Three types of statements were used in each of the field surveys in an effort to test one type against the other and to determine whether there would be any similarity of responses with regard to the three different types of population under study. Methods are not important here but for those who are interested it can be pointed out that a first set of value statements was developed for use with field analysis technique and a second with the forced-answer technique. A third set of statements was strictly architectural in character. The purpose of this set was to determine whether there was any similarity in the answers of these 3000 people between the two sets of value statements and the set of architectural statements.

When the results of these various tests were analyzed, surprisingly similar answers were discovered among the three sample groups. Rather convincing evidence came out of this study to show that the different value orientations of individuals can be measured empirically. The individuals holding the same dominant value orientations were found to have many things in common. For the economy, equality, family centrism and the physical health groups there were these apparent characteristics: The individuals tended to be realistic, insensitive, extroverted, collective-minded, practical in their demands and desired necessities instead of luxuries. They emphasized 'means' rather than 'ends'. A final characteristic was that they tended to observe their basic physical needs.

In contrast, for the esthetic, freedom and mental health groups there were these apparent characteristics: The individuals tended to be idealistic, sensitive, personal and individualistic-minded, introspective, somewhat whimsical in their demands, they sometimes desired luxuries as against necessities, and they tended to disregard basic physical needs. They emphasized 'ends' rather than 'means'. There were of course some other differences among the individuals holding different dominant values in each of these two major classes.

It was developed in this study that the housing requirements among the various value groups might vary sharply from group to group and in some instances might even be in direct opposition to one another. In some instances the practical effect of these requirements, as they may be implemented in architecture, could be the same, but underlying reasons may be completely different.

Admittedly, this first 'clinical' effort had many limitations including the restricted area of housing to which it was related. It also raised some methodological questions. On the other hand, it represented a first effort at empirical measurement on a complex subject in the areas of sociology, psychology and architecture. It is hoped that other studies will follow. For example, Foley suggested a study of the way in which values and other social wishes impinge to influence how persons or groups will react to or evaluate the product of the architect's design. Taken literally, this would be one of the refinements that could be made in the study just described. Values should be studied in regard to their influence on city planning -- perhaps on where and how people want to live. One of the most crucial questions may concern the value orientations held by the members of the architectural profession themselves. In summary, the area of values tends to represent a fertile one for research among sociologists, psychologists and architects.

In concluding these remarks, I should like to refer to a comment made by Gordon Allport. Allport, an enthusiastic supporter of 'interdisciplinary' research, has called attention to some of its possible short-comings. He has spoken of a certain 'thinness' in research production of this nature and raised some interesting questions. One of these concerns students trained in what he called a 'field of forces' which, in effect, means that they are capable of undertaking sound research work in a broad field which overlaps two or more subject areas. His primary concern is that the specialization of skills may be lost in the development of true interdisciplinary projects.

I would agree with Allport that this could happen. I also agree with Foley that architecture should not lose its strong ties with art and its traditionally humanistic orientation. However, I sense, especially in the younger generation of architects, a strong urge to develop new approaches based on 'strong bodies of empirically-based propositions' and I feel that cooperative or 'interdisciplinary' research on social values and the application of this concept in architecture is an area of research that would benefit from collaborative work between architectural researchers and sociologists.

. . . SECOND DISCUSSION OF DR FOLEY'S PAPER ON SOCIOLOGY

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Categories of those areas in architecture in which sociologists might reasonably be expected to have something distinctive to say have to do with studies of function, with studies of esthetics, and with studies of architecture as a profession. In discussing each of these my objective is to try to state things which might contribute to a growing body of practice theory, so I shall be talking about principles which supplement those already mentioned with an occasional illustration.

First of all, in connection with function, it is general in the social sciences that we deal with funny numbers. We can talk about more and less, but not how much more and how much less. Consequently our research is exceedingly hard to translate into new settings--it almost always requires a very extensive kind of engineering effort, and this is especially true as we take research which has been conducted in the laboratory and try to apply it to real life situations. Relatively speaking, research done in a pharmaceutical laboratory or in the laboratory of a physicist can be translated with relative simplicity into the field setting. The difficulties are infinitely greater when we try to translate any kind of social science research into new field settings--especially when we try to translate research from the laboratory into such settings. The consequence of this for the study of function is that if we are interested in what a space should provide for a particular group, then if we have looked at that group under controlled conditions we can forecast almost with certainty that when we try to translate this into some field setting without controls, we are going to have to do the study all over again.

A second characteristic is that unlike many

fields the kinds of knowledge we obtain about ways in which something can be changed require that people change goals, objectives and values. Now this is quite different from the situation common in medicine and in many areas of architecture. If we take a situation like that of the Salk polio shot we know that for the most part people simply want to avoid polio and with relatively slight investment of time and with relatively little pain they can get a pretty solid guarantee that they will not get polio. On the other hand, many times what we find in social sciences requires people to make such drastic changes in their style of life and in their goals and in their expenditures, that they simply are unwilling to apply it. One thing which immediately comes to mind as an illustration is the fact that we are now in a position to perform successful therapy on a wide variety of types of neurosis but, in fact, these applications and techniques will never occur for most people who need them simply because they don't have the money and society is not willing to see to it that the applications are made. So a certain rate of neurosis becomes one of the costs of doing business in our society. We spend the money elsewhere instead of on the neurotic. A great deal of the information we have to offer is of this character.

Further, a great deal of the information that we have will be disappointing to you because we will say nothing can be done about something that you would like to manipulate. Many of the considerations that are of central interest in architecture require a kind of manipulation of behavior which is unlikely to occur because what people do--for example the tastes they have in design--tend to be primarily a function of social position. Unless we were to make a drastic restructuring of the nature of the society, of the conditions under which people receive their principal rewards and deprivation, it would be highly unlikely that any program of education in taste, in design, would have any appreciable effect.

There are also some peculiarities of our theories in social science and psychology. They tend to start out and make their predictions with statements about the way the world is experienced. The professional psychologist making a technical analysis of the learning of rats does not assume that the rat learns to run the maze because there is corn at the end. He assumes that the rat learns to run the maze because there is a reward at the end, and this concept 'reward', you see, refers to a wide variety of empirical physical objects: corn, wheat, a pretty girl rat, many other things -- but the point is that the concept is a statement of the rat's experience. And we say rats who have certain kinds of experiences will then perform certain kinds of responses as a result of those experiences. Now this fact about the structure of technical theory in psychology and in the social sciences generally is a most crucial one in trying to think about applications to architecture. It is crucial because you people want to be able to make some statement about the impact of physical conditions, to describe behavior in physical terms--and the technical theory in the behavioral sciences these days is not equipped to accommodate you. More than this, there are excellent reasons for believing that it never will be equipped to accommodate you. In principle there are inherent reasons for never getting any kind of independent variables, as we like to call them--the things from which we make predictions--other than statements on how the world is experienced. So there is a gap between statements about the

physical world described in physical terms and statements that enable us to make some predictions about behavior.

Now the reverse is also true as we try to move from statements about what people desire -- or what their values are -- to the kind of physical conditions under which these can be satisfied. This fact, that our technical theories are stated in experiential and behavioral terms, means that there is a gap. There is no language of translation going in this direction either, that is, from values to physical specifications, and on this side, too, there is every reason to believe that in principle there cannot be a technical language for making the translation. The consequence is that we build up a kind of actuarial knowledge, if you will, between the technical language of the behavioral sciences and physical conditions. This is actuarial in the sense that your insurance company's information is actuarial. The insurance company doesn't have to know why it is that married men tend to live longer. It doesn't have to know why it is that school teachers tend to live longer. It doesn't have to appreciate that about our only occupational hazard is chalk-dust, a sort of academic silicosis, or on rare occasions an irate student. All it has to know is that this is, in fact, the case, and it builds up lovely tables from which quite accurate judgments can be made, and certainly the profit margins of the insurance companies suggest that they are being made.

We shall need a kind of knowledge of this sort in order to make connections. We shall need lots of demonstration projects in which hunches based on technical theory in the social sciences and psychology get tired out to see if they work -- but there is not and probably cannot be any rational set of translation languages to guide us over this hump. It becomes a matter of experience and we shall have to try to systematize our experience as best we can. I suppose an analagous situation is that in the area of time-and-motion studies. (Well, I have been trying to talk about three characteristics, now, of the nature of our knowledge in social science, sociology in particular, psychology as well, which have some important bearings on what you people may get from us, and the kind of inter-action you may expect.)

I would like to say something briefly on the subject of esthetics, again in this spirit of caveat emptor. From what has been said around the table today, and from the papers, it's quite evident that architects see design as the core of all their efforts, and this would suggest that esthetics should be one area in which sociologists and psychologists might make a significant contribution. The fact of the matter is, however, that this is perhaps the least developed area in either of these disciplines. It's my observation -- having an interest in the topic -- that when I turn to the psychological abstracts six times a year to look at articles that have been published under the heading of esthetics, there are two or three or in a banner period six. Most of them are speculative and suggestive. or else they are quite physiological in character. They have to do with rods and cones in the eye, and their characteristics for the perception of forms, and that's about it. If I look at the sociological abstracts I have a similar experience. The observation that I wanted to make, which might fall into a body of practice theory in the area of architecture, is that by and large the kind of research which you will find useful from us is not the stuff which emphasizes psycho-physics -- for instance, which emphasizes color in the sense of psycho-physical color perception. By and large, what you

need-- what we cannot now give you-- and what is very scientifically sexy (I love Mr Kelly's phrase)-- is the whole problem of esthetic values as social norms. Whether or not a particular form or a particular color arrangement is desired by your client is not to any great extent, as I see it, a matter of rods and cones in the eye. It is primarily a product of his social experience and much of that experience is available to the investigator in the form of the social norms of this person. Well, we know where to point in this direction -- we know what is relevant for you and what is less relevant; but there just isn't much in the way of systematic development of the area in the form that I have mentioned.

I am struck with the high ideals of architecture, the desire to help man, the desire to lift him to higher and nobler things. But, gentlemen, in my experience architects are also businessmen, and I would like to propose that it might be very helpful to consider that a first need of the architectural profession is to get a customer, and once you get him to retain him. This suggests a rather different slant from the ones that have appeared in the papers presented. It suggests that the relationship between the architect and his potential public needs examination. Some people whom I know tend to look upon going to an architect as they do going to a psychiatrist. There are a lot of expectations in common: One of them is that he is expensive, the second is that he has some kind of a mysterious archaic knowledge and you can't really make any judgment in advance as to whether he is competent.

It's quite clear that the profession of architecture has not managed, as has medicine, to reassure the public on this score. Psychiatry as a kind of border area of medicine is having a great problem. Curiously enough in New York State the psychiatrists do not want to be known as psychiatrists in the telephone book - they want to list themselves as psychologists because the connotation 'psychiatry' is that you are a head-shrinker. Well, there is something about architecture that has this same mysterious horror.

Let me suggest to you that there is a third kind of relationship between the client and the architect which comes to light if one thinks of the architect as a business man. And again thinking of the similarity with psychiatry -- when you come to the architect's office you are expected to bare your inner soul because the area of taste is a very intimate kind of thing. Taste is a hallmark of your social position, it is a revelation of your education, it epitomizes you as a person. How can you reveal to this man these intimate things? Perhaps we should have a couch in every architect's office. Suppose you say I won't reveal it to him, I'll depend on his good will, on his competence, on his taste. But his taste may not be yours, so you are up the creek. All I am trying to propose by these illustrations is that it may be fruitful to add yet one other bold image to those which appear in the papers which you have before you, and that is that the architect is, among other things, a businessman and the first problem of the businessman is to get a customer. And fortunately in this area we have a lot to offer you because the area of management and sales relations is fairly well developed.

ENVIRONMENTAL HYGIENE AND ITS MEANING FOR ARCHITECTURE

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Environmental hygiene, or sanitary science as it is more commonly known, deals with the control of diseases whose transmission or propogation is fostered by defects in the environment. The field is most closely identified with the medical sciences, and like them is intertwined with the physical, chemical and biological sciences. It is inescapably concerned, also, with various aspects of the social sciences. Practitioners in sanitary science have various backgrounds of training, but engineering tends to be predominant. In many respects, sanitary or public health engineers tend to be like architects and city planners. They must have considerable knowledge about a wide variety of things; and they must be able to relate many seemingly disparate kinds of knowledge in their efforts to manipulate the environment for protection and improvement of the public health and safety.

As I understand the fundamental mission of architecture, it is to bring into being the finest possible application of art-form to the problems of daily living, now and in the future. This seems to me to imply that the architect is basically an artist -- one whose principle objective is to give form to ideas and to concepts that are not readily -- if at all -- made tangible by others in our society. If this be true, it follows that the architect is one who, like the practicing engineer or physician, deals primarily with the products of research and investigation.

The advancement of environmental hygiene has been largely dependent on progress in utilizing the products of a variety of research efforts. In some cases, empirical approaches to the solution of certain environmental problems have set the stage for disease control. For example, by the time the causative agents of typhoid fever, cholera, and the dysenteries were identified, it had long since been demonstrated that filtered water was far safer than raw water. But it usually has not been possible to pinpoint the attack on a disease until its causative organism has been positively identified. The only exception that I think of is in the control of smallpox by vaccination. Virtually all experience in sanitary science indicates that, until the precise cause of a disease is known, it is almost impossible to deal with it successfully.

Assuming that one of the major objectives of architecture is to create an environment for man which is healthful and safe, the rate of progress in the art will be no faster than the rate at which empirical or scientific knowledge is accumulated and applied. While there has been significant progress in providing the tools for environmental control of many communicable diseases, society still lacks the precise knowledge that will be necessary to bring many of the psychological and physiological impairments of man under control. Thus, architects and city planners have a major stake in -- though not necessarily a direct responsibility for -- efforts to expand our

knowledge about the relationship between environment and the health of man.

I will attempt in this discussion to: (1) bring out a few major points relating to the impact of environmental hygiene on the field of architecture; (2) outline some of the problems inherent in trying to blueprint de novo a broad research program; and (3) indicate the difficulties that will be encountered in attempting to launch a research program of any magnitude in a field as diffuse as is architecture.

The Impact of Sanitary Science on Society

Those of us who have spent our lives in the health professions and especially in sanitary science tend, I think, to overlook the clear relationship that exists between the control of water-borne disease and urbanization. Among the major forces that have made great cities possible has been the harnessing of water -- pure, safe, potable water -- without which no community can develop and survive. And yet, the full flowering of great metropolitan areas is more and more being threatened by absolute shortages of water.

Unquestionably, further advances will be made in the art of providing water supplies to metropolitan areas. Many of us here now will see the day when cheap energy will make it economically feasible to use sea water for domestic, industrial, and agricultural purposes. But domestic use of water produces sewage. As more water becomes available and is used, the problems associated with the disposal of liquid waste will grow and become more serious. We must never lose sight of this essential fact. Furthermore, the development of industry produces an ever-increasing demand for water, and the problems of industrial waste disposal become increasingly complex.

As a result of a great and growing need to find better solutions to waste disposal problems, there has been increasing professional interest in the development of adequate measures for the treatment of municipal and industrial sewage. Yet, there have been almost no significant advances in the art of urban sewage treatment in the past four decades. And we still have the septic tank with us! Furthermore, the amounts of money being spent in the United States in the search for improved methods to treat domestic sewage are less by far than the sums spent each year by a single large city for the disposal of its own sewage.

Concern with the disposal of industrial wastes -- which in many instances reflects the public relations needs of business -- is evidenced in the increasing attention to research on methods of industrial waste treatment. But the heavy investment in industrial technology and development is resulting in a myriad of new compounds used in manufacturing. Many of these produce wastes that are difficult to treat, thus adding to the pollution burden of our streams and to the waste treatment problems that must be solved through research.

As society tries to cope with the increasing quantities and complexity of municipal and industrial sewage, it is simultaneously being pressed by the burden of disposing effectively of other municipal wastes. There have been relatively few advances in the technics for efficient disposal of refuse. And as population concentrations grow, the sites for refuse disposal become more difficult to acquire and reach, the costs of collection and disposal go up, and the potential contribution to atmospheric pollution becomes even more significant.

One might assume that society long since would have concerned itself with the control of atmospheric pollution. To the contrary, it has only been within the past few years that any serious approach to the problems of community air pollution has been made. We have little information on the health effects of air pollution. Indeed, there are few qualitative technics to use in measuring and identifying specific components in the atmosphere. Even for their partial identification, which is now possible, the procedures are tedious and expensive, and only a few laboratories in the country are equipped to carry out such procedures. Yet, with the history of significant episodes of serious community air pollution in this country and abroad, we cannot long delay the mounting of a substantial program of research, both epidemiological and chemical. Furthermore, there is just beginning to be an appreciation of the potential impact of radioactive substances of various types in the air we breathe and in the food we eat and drink.

Why do I stress these sanitary engineering problems at a conference on architectural research? Basically, because they are problems that will be of increasing concern to the architect and the city planner. Even though these are problems of great interest to the architectural profession, it seems clear that the profession is not equipped to make fundamental contributions to knowledge with respect to the health implications and control of the hazards associated with water supply or sewage disposal or refuse disposal or air pollution. Indeed, there is every reason to believe that the new knowledge that is needed is more likely to come from the physical, chemical and biological sciences than from either sanitary engineering or architecture. But the architect or city planner -- like the sanitary engineer -- can serve a useful catalytic function by constant stimulation and encouragement of those who are involved in the support and conduct of research and technical investigations in these fields. In fact, he must press for the solution of such problems if his own efforts to improve the living and working and recreational conditions of man are to be successful.

Blueprinting a Research Program

Careful consideration of the development of a new 'research' program requires understanding of the basic difference between research and technology. Research involves a diligent search for new knowledge. Technology has as its target a definite end-product.

One of the most difficult problems in charting any broad, long-range research program involves the basic fact that research in any field is an evolutionary process. One discovery leads to another, and it is impossible to predict where a given line of investigation will lead. For example, DDT is a product of research. It was first synthesized in the latter part of the nineteenth century, and originally was used for the control of potato bugs in Switzerland. It was not until the early days of World War II, when an all-out attempt was being made in the United States to find positive measures for control of malaria, that its lethal properties against mosquitoes and lice were first identified. Subsequent investigations indicated that DDT is also a potent weapon against other insects of health and economic significance. As time went on, however, it became evident that extensive use of DDT produced evolutionary processes in many insects, including mosquitos. They became resistant to this chemical compound. Thus, an extensive new program of research on the insecticidal properties of

closely related chemicals was undertaken, and new compounds were developed. Whether or not these will in turn produce insecticide-resistant insects is not presently known.

I cite this example to point out that while research often produces highly useful products (or building blocks), it may also create additional problems. There is never an end-point. Thus, any attempt to blueprint a research program may turn out to be a frustrating experience unless it is aimed at certain broad targets rather than specific end-points. Was it Pettenkofer who said: 'The experiment that succeeds teaches nothing'?

Those of us who are concerned with sanitary science recognize clearly that the kinds of research that we need in our field have little popular appeal, although there is growing public interest in air pollution research. Hence, in the competition for research dollars, the sanitary scientist is an 'also ran' in comparison with his peers who work on dread diseased such as cancer, heart disease, diabetes, and the like. In the broad field of research support, it is clear that public interest in space and atomic energy research is infinitely greater than in environmental hygiene. This is not necessarily sheer debit, however. Indeed, in the long run, it may be a valuable asset. It seems abundantly clear that biomedical studies associated with exploration of space, or with research on fission and fusion processes, have the potential in the years ahead of contributing significantly to better understanding of the environment in which we live.

As we think of the problems with which the architect must cope, what are the potential contributions to architecture of biomedical studies related to the development of the atomic submarine? We now have actual experience in the crowding of scores of men for weeks on end far beneath the surface of the sea. Apart from the sanitary and physiological aspects of this new experience, what psychological lessons have we learned, and how may they be useful in the development of building standards? Does this experience have any significance, for example, with respect to the need for windows in schools or office buildings or even in dwellings? (In contemplating the possible values of windowless structures, we should not overlook the need for fire exits!)

It is currently estimated that it will cost $200 million to put the first American into space. I have no idea what portion of that budget will be spent for biomedical research. However, it seems certain that some of the findings in some way will be useful to the earthbound architects. The physiological and psychological problems that must be solved for the spacemen may give us leads for use in meeting problems in our earthly environment. Similarly, how may research at Oak Ridge or Brookhaven or Hanford be useful in finding ways to improve the design of ventilation systems, or the control of community air pollution, or the disposal of liquid wastes?

The point I am trying to make is that there are already in being tremendous research activities sponsored by Government and private enterprise in our efforts to harness the atom and to conquer space. Many aspects of this research may be useful in the search for knowledge that will be useful to the architect. The question arises: Is it reasonable to expect the architectural profession without substantial additional scientific training to add significantly to the work of the scientific community in searching for new knowledge, some of which can

be applied to improve environmental hygiene; or are architects more likely to make a useful contribution by finding ways of applying new knowledge as it comes available?

Difficulties of Organizing Architectural Research

One of the major problems the architect has as he approaches the development of a posture for his profession with respect to research is that for the foreseeable future public officials and scientists will together play a leading role in the planning and organization of this Nation's major research efforts. I am convinced that we are approaching the threshold of public interest in the social sciences, which are also of concern to the architect. But as I have watched the development of research in the medical sciences, I am more and more aware of the part that public demand plays in developing adequate support for scientific inquiry.

It seems to me that the architectural profession, in its proper concern for research, must rely to a very heavy extent on the leadership in various professions and scientific disciplines to cooperate in a common search for knowledge. If, as is frequently said, the architect is a coordinator and user of knowledge from a vast panorama, he must prepare himself to work closely with the scientific investigator. However, without very extensive training in the sciences, he is not likely to be a prime producer of knowledge.

I suppose the architect, possibly more than anyone else, recognizes that one of the important gaps in our social structure involves the lack of efficient machinery for the winnowing of new knowledge for utilitarian purposes. It seems to me to be an open question as to how best the architectural profession can balance its efforts with respect to laboratory research. How far should it go in trying to launch its own fundamental research program, particularly in the face of the present intensive national efforts in allied fields? Or is the temper of the times such that architecture would be better served if it were to use its resources in stimulating and supporting efforts to speed the efficient utilization of new findings from research conducted under other auspices?

How can the architect and planner take advantage of knowledge developed from scientific research? There seem to be two possible approaches, although they are not mutually exclusive. On the one hand, if he is to enter actively into scientific research, the architect -- like the engineer and the physician -- will require very intensive and long-term training in one or more branches of basic science.

The other approach to solution of the problem would involve the organization of machinery which will insure bringing broad-minded and understanding members of the scientific fraternity into close and regular contact with the architectural profession. I have no suggestions as to how this can be done, but I would call to your attention the success of the American Public Health Association Committee on the Hygiene of Housing in utilizing first-rate scientists and broadly experienced administrators in a common effort.

As I pointed out in the beginning, architects and planners are very much like sanitary engineers. They must have considerable knowledge about a wide variety of things. I would emphasize, however, that the sanitary engineer has to rely for advancements in knowledge on the efforts of

individuals far more skilled than he in a broad spectrum of scientific disciplines. Perhaps this is the best lesson that architecture can take from the field of environmental hygiene.

. . . DISCUSSION OF MR POND'S PAPER ON ENVIRONMENTAL HEALTH

Lovic P Herrington, Director of Research, Pierce Foundation, and Department of Public Health, Yale University

Environmental Hygiene and Architectural Research.

Two points made in Allen Pond's paper on environmental hygiene and its meaning for architecture were, first, the analogy drawn between various branches of engineering connected with public health, hygiene, and environmental physiology; and the problems of the architect and the engineer. It was said in this connection, and I largely agree, that people who study these problems from either a health or an architectural standpoint are largely dependent on the use of information of more basic character developed in special disciplines. At least in the beginning, therefore, research in architecture in the area of human environmental effects would probably find it convenient to follow this profitable model.

The second point stressed was the practical one of the use of funds made available for the training of able personnel for accomplishing the general aim of the program. This item involves, therefore, the important question of educational curricula.

On the above points I certainly agree that the parallel between public health and architecture with reference to community and social responsibility is similar. The need for a definition of the educational requirement of research-oriented architecture has been given little discussion here. Perhaps the examination of that question itself would answer many of the problems that have been posed, in a more general way, as to whether one can conduct fundamental research on a subject such as architecture.

Although we have not discussed the specific training of architects for research, the implication of our discussion has been that the experience of the architect in gaining his training and in his practice is 'clinical' to a considerable degree. We have also noted that it incorporates features that we would consider formally similar to research in some of the engineering sciences. As a result, I think we will all conclude that architecture is a very complex discipline, both materially and socially.

In such a circumstance, perhaps I can contribute most to the exploratory theme of this conference by foregoing conclusions re architecture and research and stating a case history which relates environmental physiology (in which I am interested) to the physical features of buildings and perhaps also to architects and sociologists. While this is in a sense a trivial problem, I select it because it clearly involves the induction of behavior by architectural forms in a manner that is in one connection

physiological, and in another, a matter of association and behavior conditioning. In a broad sense, one might consider (as Churchill's remarks on the architecture of the House of Commons would indicate) that organized knowledge on the behavior inducing properties of structures is one of the research areas which is at present undeveloped.

Let us take an example, remembering that health and sanitation re building structures are not always as esthetic as other elements of architecture. In a public housing project I am acquainted with, one of the problems has been the tendency of younger members of society to urinate in the elevators and elevator wells. Now this isn't a very esthetic subject. It is an architectural subject, however, because apparently this behavior does not occur, or is not common, re the stair case. It appears, therefore, that there is something about housing, perhaps for particular social groups, which influences the young to make this unconventional use of elevators - and not stairs.

Of course, research is not always highbrow. However, study of any consistent phenomenon often leads to fairly fundamental relations. It is conceivable that an understanding of the above annoying problem is one which involves knowledge of facts in disciplines as separate as architecture, physiology, sociology, and sanitary engineering. It might even involve the police department.

To give you a clue as to how one might proceed without actually making this anti-social behavior the subject of an experiment, I think a psychologist would approach this affair through the formal similarity that exists for young adults between taking an elevator and going into a rather small cubicle, closing the door, pushing a button, and experiencing tension reduction.

On the other hand, we still need a working hypothesis as to why stair-wells are not used. In this connection, the physiologist can make the suggestion that when you get into an elevator you may go up, you may go down, but one of the things that does occur is that the fluid pressure in the bladder is substantially altered and this may be a stimulus for micturition. Here we may have the induction of a behavior, which could well be related to (a) physiological stimulation applied by an acceleration device, and (b) psychological stimulation producing a specific induced behavior; in this instance a kind of induced behavior which the architect certainly did not have in mind, or the engineer did not have in mind, when he furnished the environment with an elevating facility.

I have no intention of suggesting that research on the above behavior be made a major project. The example is useful, however, in suggesting the multiple sources from which structure-induced behavior may arise, and also, the great probability that considering the above behavior as primarily a disciplinary problem, would probably never lead to insight into the complex manner in which our structures affect us.

Usual studies of the physical effects of heat, light, sound, and other ecological factors which our structures modulate are directed to rather obvious human utility and comfort factors. However, it may well be that very current studies of sealed and synthetic environments, in particular those on the effects of sensory deprivation, may open the door for an area of architectural research in which quantification of the deeper interaction between the physical environment and human action may fully justify the term 'architecturally induced human behavior.'

Douglas H K Lee . Quartermaster Research & Engineering Command, Natick, Mass.

Environmental Hygiene and its Meaning for Architecture

From time to time I have heard physicians claim that housing should be regulated by the medical profession; today we have heard architects imply that health may be considered the responsibility of architecture. On the face of it, both are exaggerations born of provocative argument. Architecture has a mission in which health must be preserved if the mission is to be satisfied. Medicine has a mission which will not be successful if housing is permitted to fall below certain hygienic requirements.

It is clear that the theory and the practice of architecture must give proper consideration to the control of disease, and to the amelioration of conditions militating against physical and mental health. In short, it must provide that measure of control over the physical, psychological, and social environments that will minimize their adverse effects, without detracting from their desirable aspects. Against the major or most intense hazards the need for protection is obvious, and the methods for effecting it fairly clear. It is against the relatively minor but long-continued, or against the major but infrequent stresses that action may be difficult. Somebody has to balance the cost of architectural action against the loss to human values if action is not taken; and for such a judgement, the intangibles may count as much as the tangibles.

The individual architect is not trained in the practice of public health, still less in the applied sciences supporting it (medicine, epidemiology, industrial hygiene), and usually not at all in the contributory basic sciences (biology, biochemistry, biophysics, physiology, microbiology). The question arises, however, whether architecture may not achieve what the individual architect cannot. It would seem, not merely feasible, but highly desirable that the architectural profession, through some provision in its organized structure, encourage the range of pure and applied sciences and scientific arts to give more considered attention to the needs of architecture, and develop communications between the biosciences and architecture.

I would like to enlarge the paragraph on page 5 of the AIA Special Report No. 4, A Statement on Architectural Research, to include, not only 'psychology, optics, and the social sciences', but all the applied and contributory sciences mentioned above. To the areas of mutual interest between public health and architecture cited by Allen Pond I would like to add one insufficiently stressed, except indirectly by Guy Swanson and L. P. Herrington. This is maximal realization of self, for without this the occupant must necessarily be something less than his true self. We know far too little about the psychological impact of the environment upon man, with the result that our much vaunted remedial or preventive measures are not far removed from folk lore. Here is a real challenge in which architecture must play a leading role.

The prospect of facing the wide range of knowledge involved, and from an ever-expanding universe of information of drawing an understandable and usable set of action patterns, is certainly intimidating. Swinburne himself has evidently overcome this effect, but I wonder if he has gathered many recruits to help him explore the ramifications of his comprehensive charts. I am convinced, however, that it can be done. I am convinced because I have seen something of this nature done twice, although on a smaller scale. One of the major objectives of the Quartermaster Corps is to promote the operational efficiency of the soldier through attention to his clothing, personal equipment, and food. In the prosecution of this objective basic sciences (chemistry, physics, biology, mathematics), applied sciences (environmental physiology, materials research, geography, climatology, nutrition), development technology (clothing, personal equipment, food technology, packaging, materials handling equipment), and logistics are all involved. These are integrated into a well-patterned and fairly smooth-flowing process by cooperation and management, adequately supported by funds and facilities. Again, as a limited effort, the Council on Foreign Relations brought economists, agriculturalists, physiologists, public health experts, geographers, and political scientists together in a series of meetings to prepare a balanced and factual report on the possibilities of economic development in the tropics.

It can be done! The question is how? To be specific, I would suggest that the architectural profession, if it wants to take definitive action itself and not leave it to chance interaction, do four things: (a) develop a strong intermediate group capable of looking both ways, at architecture itself, and at the contributory sciences; (b) give it strong and courageous leadership; (c) guarantee it support on a long-term basis; and (d) listen to it, constantly. The details can be argued at length, but the pattern seems inescapable - if the profession really wants to do something.

PLANNING AND SCIENCE

Burnham Kelly, Associate Professor of City Planning, MIT

Planning and Science.

The impact of science on the physical design professions like architecture and urban planning is exceedingly broad, playing a part in every step of the design process. In order to break the subject down to manageable dimensions, I have arbitrarily divided our professional concerns into two types. (1) Those dealing with the 'hardware', the how-to-do-it, or the construction aspects of building and (2) Those dealing with the concepts, the what-is-wanted, or the design aspects. Most of the scientific effort, it then becomes clear, has focussed on the former, for construction is tangible, visible, and usually lucrative whether the subject is towers or turnpikes. Even in the construction aspects, however, true science is rare, and its effect on designs diffuse.

At the elementary level, construction research is concerned with facts and principles. Basic requirements for human life, fundamental properties of materials, and forces of nature and time are problems for a scientist, beyond doubt, but the vast bulk of information needed for normal

construction has long been known and represents little challenge to a dedicated researcher. Our best scientific brains can rarely be interested in the fundamentals of architectural or urban construction.

Applications of these fundamentals are in the hands of engineers, and here, too, the challenge is pale compared to that of electronics, nucleonics, or space travel. Yet industrial potentials in the construction field are vast, and therefore significant developments have been carried on. Only through the use of new techniques has it been possible to assemble structural members by the chemical action of adhesives, to use air pressure as the source of support for buildings, and to develop efficient controls for city traffic. Because buildings and roadways are typical of the interests of large enterprises, money is available to study such problems as these, and lucrative careers may be had working on them. Hence detailed information has been accumulating over the years in the construction engineering field. Because the fundamentals are well-known and the resistances to innovation are deeply entrenched, however, this field is not rich in scientific brains. The typical construction engineer is more a doer than a thinker.

Even more important to construction operations, and at an additional remove from a fundamental scientific base, are the regulations of the administrators. For the average architect or urban developer, such science as does not come in the form of gift-wrapped packages from materials salesmen or rules of thumb from mechanical equipment engineers is predigested in the regulatory processes. The average architect will confess, unhappily in most cases, the degree to which the building code is his pipeline to scientific truth, and the average urban developer will make similar noises about zoning ordinances, subdivision control regulations, and the requirements of the FHA. If a fundamental fact hasn't penetrated the un-sound-barrier of these administrative controls, it may as well not exist.

Turning to the designer himself, we find him showing his understanding of construction principles in specifications and detailed drawings, for which he tends to hire specialized men who are regarded neither by him nor by themselves as creative designers but only as reliable interpreters of his ideas in the practical situation presented by the immediate job. At this level, we have left the typical long range planner behind, for his efforts rarely advance to so concrete a stage, but the typical developer has comparable limits.

Final construction decisions are made at one more remove from the scientific base; they reflect the cost concerns of the builder and the client. In the real world of the construction industry, the facts of cost are overwhelmingly the most important, as perhaps they should be. But they have tended to dominate the horizon so completely as to block the distant view of towering potentials and innovations. A penny saved today is nowhere more valuable than in the construction industry, where one might expect a broader interest in performance over the course of many decades.

What may we say about this series of separations of the construction function from its scientific base? First, it is obvious that there is far too little exploration up and down the whole series. The specification writer does not look behind the codes; the code writer is content to use current engineering practice; the engineer rarely ventures outside of the narrow confines of a well-exploited special

background; and it is an unusual man indeed who runs around end to make the discoveries that will open the way to real progress. Each step in the series obviously should reflect familiarity with the limitations and opportunities of every other, for only when a designer can see the process whole can he put into effect the major improvements that should follow scientific advances. Only when there is a feed-back from design experiences on the firing-line, can scientific attention be turned to the most pressing problems.

Second, because certain details of construction are tangible and measurable, they give a false sense of concreteness and exert undue design influence. A detail should not become dominant simply because it can be fully analyzed and be given specific dimensions. Yet by and large just this has been happening in the design professions. Because solar geometry is specific, it may be made the major design element when other factors of climate and light are more significant. Because origin-destination counts can be quantified, they may be used to lay out roads that will serve areas and purposes not subject to 'counts'. There is a strong suspicion of pure fashion as each new bit of factual knowledge becomes a 'must' feature of new designs. In short, there is often a tendency to lean far too heavily on the scientific aspects of what we have called construction.

Turning now to the function of design, as the term is here used, what is the role of science? From the time of Vitruvius to the early part of the present century designers attempted the systematic analysis of the intangibles of the design process, and then suddenly they stopped. Has the study of design lost its interest? Is a careful and logical program analysis all that we need?

In essence, what happened was that construction technology outran design theory, demolishing many old ideas and leaving insecurity in their place. For many designers, of communities as of buildings, designs in an industrial civilization are directly derived from the characteristics of construction. What is possible within the limits of costs, codes, and time is good because it is possible. What is not possible within these limitations (and little is possible, when the attention is focused on limitations) is to be contemplated only by students and dreamers, including an occasional Great Man whom everyone pardons because he is essentially an artist. A more refined group makes it a principle that good design positively reflects the system of construction, assuming first that the basic function to be served may be generalized and expressed and then that a construction by which the function is well expressed is ipso facto good design. Injustice is done to these views in so brief a summary, but it is fair to say that they do not concern themselves with a scientific basis for the function of design.

There is a determinist fringe of science-awed designers, however, who go so far as to suggest, directly or indirectly, that one day we shall know the necessary facts on all subjects, including the most complex aspects of the mind and personality, and that at this point design will be a simple matter of assembling the details and deducing a scheme. Somehow one imagines a great machine into which the variables are fed and from which, after a decent interval for computation, emerges the answer, Q.E.D. That this view is a vast oversimplification I hope is obvious.

Taking the opposite of the determinist view, many designers today seem to believe that only the intuition may be trusted

and that science has nothing to do with design. All the old rules were illusory, say these designers, and they do not exist for modern conditions. For many of them, the form itself is now the thing, and the role of the engineer and builder is to make the chosen form workable in the desired application, even though a certain amount of trickery and extra effort may be required.

Far be it from me to scorn the intuition, if by this is implied a creative insight based on general background and experience. Certainly it is as much needed as a sound understanding of construction, and often more so. And those familiar with creativity in science do not scorn it.

'On looking into the history of science, one is overwhelmed by evidences that all too often there is no regular procedure, no logical system of discovery, no single continuous development. The process of discovery has been as varied as the temperament of the scientist...precisely some of the most important contributions have initially depended upon wrong conclusions drawn from erroneous hypotheses, misinterpretations of bad experiments, or chance discoveries.... Even the work of great heroes, viewed in retrospect, sometimes seems to jump from error to error until the right answer is reached as if with the instinctive certainty of a somnambulist; indeed this gift must be one of the deepest sources of greatness.' *

It may be that an important role of good design is to postulate solutions, and generally to do some original theoretical work for the science of planning. Does the imaginative designer, in the comprehensive conclusion he prepares from a mass of intangible and little understood experiences and impressions, perform the vital role of exploring hypotheses for which scientific tests may then be constructed and carried out?

If this is an important role of design, how may the process be studied and applied? Since less than half of the crucial questions affecting a designer's decisions may be explored and answered with any degree of reliability, it becomes essential to learn how to deal in intangibles, how to come up with design postulations, and how to recognize the best of these when one sees them.

This is not a problem for architects and urban planners alone. Engineers also are anxious to learn how to develop, and generate a respect for, the ability to produce a creative design. At MIT, where curriculum change is the steady state, a growing interest is being shown in the drafting room and workshop methods of the architects and planners because of the stimulus they give to this ability.

But the essential feedback from designs to the scientific base barely operates at the present time because of obstructions in the communication channels and because of the obvious difficulties in setting up the experimental and analytical studies necessary to evaluate, verify, or modify these proposed solutions. Probably a first requirement for the development of such studies is the summary statement of some of the problems in what Robert Merton might accept as clinical terms. Let us explore this problem by means of an illustration from the urban planning field.

That it is difficult to develop a systematic approach to the determination of goals and objectives will be readily conceded by

** Gerald J. Holton, "Duality and Growth in the Physical Sciences," American Scientist, vol. 41, no. 1, January 1953, p. 90*

anyone who has tried. This does not, however, justify the conclusion that only intuition and political compromise are effective tools for this process. Just as the architects are beginning once more to worry about general principles of building design, so are the urban planners seeking out the goal-form relationships at the urban level.

A recent article, by Kevin Lynch and Lloyd Rodwin, is squarely on this subject, and I hope it will stimulate controversy.* Starting with the premise that it is essential for urban planners to develop a systematic evaluation of the possible range of urban forms in relation to human objectives, the authors discard descriptive analysis, analysis in terms of changing function, and the practical approach of specific problem solving, in order to tackle directly the relationships between physical forms and the goals they are supposed to serve. The article merits reading in full, and probably requires it for full understanding, so rare are serious attempts of this sort. Suffice it to say here that the authors establish rigorous criteria for the categories by which form may be analyzed: such categories must apply and be significant at the urban scale; they must deal either with physical form or with the distribution of activities, but not with both at the same time; they must apply to any type of urban settlement in any place at anytime; they must be subject to recording and testing; and finally they must have a significant effect on the objectives to be obtained and include all features of that type that are significant. It is easy to see that the very hardest steps in this process of analysis will be the definition and use of categories able to meet such criteria. The authors suggest five, illustrating their use in a simplified model, and set them into a matrix constructed with two basic parameters: the distribution of specially adapted spaces, and the flow system. Having thus attempted to pin down form variables, they then set out a means of analyzing the goal system with the same degree of rigor, and suggest the manner in which the matrix might eventually be used to make comparisons, to indicate needed correlations, and to reveal gaps in essential data.

Needless to say, this is only a first step, and there will be many faults to find with it. It will certainly be claimed that this approach requires more data and more complex manipulation than may ever be justified by the results that can be expected, but if the approach has merit, some means of working it out will be found. This may be illustrated by the years of work devoted to specifying and collecting the data upon which is based the important field of input-output economics. In the area of urban form, numbers may never be so definite, but suitable approximations will be developed if it is clear how the approximations can help to improve final performance.

If rigorous clinical statements of this sort can be developed, the happy day will be at hand when the practicing designer can get effective help from the scientist, since both of them will have a far better idea what sort of help is needed, for what purpose, and at what level of reliability. It is easy to say of the social scientist, for instance, that his contribution has been interesting, even fascinating, but of use mainly to fellow social scientists.

*"A THEORY of URBAN FORM," Journal of the American Institute of Planners, vol. 24, no. 4, 1958, p. 201

Designers must recognize, however, that scientists will not attempt to obtain scarce funds, take significant technical gambles, and otherwise expose themselves to the fire of their professional colleagues if they believe that the effective determinant of design is the designer's intuitive understanding of each problem, and that the findings of science (always excepting those that may be lined up in support of the designer's chosen solution) may be damned.

Having underlined the importance of a systematic basis for clinical research. I would like to suggest a few other problems at the urban planning scale for which good clinical statements are needed. First, the problem of perception of cities. Initial studies have been conducted at MIT in this field under the direction of Kevin Lynch and with the support of a grant from the Rockefeller Foundation, but this excursion to the foothills only makes the mountain ranges appear larger. Needed is a skilled investigation of the complex and dynamic urban environment, which might eventually broaden from problems of perception to the total range of psychological impact of cities. A possible next step would be the creation of a team made up of an urban designer and a perception or social psychologist, beginning with general investigations of city impressions of various kinds of people (children, white collar workers, etc.) engaged in different activities (driving, shopping, remembering) in different environments (slums, metropolitan centers, night time, spring). These might later be made more precise by investigating such questions as how city form is grasped, or how meaning is read into its parts. People might be interviewed en masse, techniques such as thematic apperception might be employed, actions in controlled situations might be analyzed. This new direction in city studies could eventually guide the design of urban areas, or of the architectural elements to be set in them.

Another study might explore what could be called the nature stereotype in the mind of urban designers. High intangible value is placed on fresh air, sunlight, green space, trees, water areas, and other phenomena of nature, and public opinion appears to support these high values. Yet it becomes increasingly possible to substitute artificial for natural conditions through technology. Offices are sealed and air conditioned. Artificial illumination is provided throughout the day. The thermal environment is carefully calculated and engineered, whether or not it is carefully administered in the final operation. Mechanical means supply both exercise and entertainment.. At what cost, economic and otherwise, are adaptations made to these environmental changes? What intangibles and tangibles are found in the natural environment that the substitutes do not, perhaps cannot, provide? How important socially and biologically are grassy yards, parks, greenbelts, and the walk to work? What do the Swedish risk when they move substantial numbers of offices underground? In short, what are the values of nature that cannot be supplied by any reasonable expectation of technological change? When may the nature stereotype be abandoned, and when must it be held high?

From the high degree of mobility -- physical economic, and social -- associated with typical families now and in the future comes the next problem. If we are to become a nation of nomads, will we tend more and more to devalue the importance of fixed real property such as houses and cities by comparison with movable personal property such as furnishings and automobiles? Where it is the urban folkway for apartment-dwellers to move each year, the

furniture seems to take on a family importance far greater than that of the dwelling unit. For well over one million US families, the mobile home, or trailer, has a special kind of appeal, even though in fact ninety percent of these units are used as permanent dwellings and their inhabitants move scarcely more often than those in the same age and occupation group in the general population. Some claim that people are beginning to devalue automobiles as status symbols, and may before long consider them a mere service, with boats and vacations replacing them as status symbols. Is there reason to believe that the home and neighborhood will become less important, or will they gain significance as the major stable elements in a fluid pattern of life? If the home, school, shopping center, factory, and office are becoming neutral attachments, readily shifted over time, then important questions face the design professions. Should an effort be made to counter these trends, or must they be considered as social forces to be accommodated in future plans?

From the point of view of rational design, there may be some advantage in a situation in which these functions are regarded as services to be designed for efficiency rather than for the gratification of individual preferences. The general level of design may rise when professionals deal with entrepreneurs who must maintain services over a long period of time rather than with a semi-educated public whose ideas are all bound up with emotions and traditions, not to mention the half-truths of modern salesmanship. It may be an idle dream that we can develop an educated public in a complex area of design; major products to which the public response is fairly direct, such as the automobile and the small boat, offer little indication that fundamental quality inevitably emerges triumphant.

Physical as well as social science problems arise from the trend toward mobility: for example, in the field of transportation. Old-style traffic engineering could no more solve the emerging urban traffic problems than dikes could contain the Mississippi; in both cases generation, storage, and destination factors had to be considered. Urban planners have gone further to study the relationship between access and land use categories and intensities, so that many flow problems may be avoided rather than solved. But in the future, as mobility increases, transportation must be studied in even broader terms, encompassing all movements of people, goods, messages, and ideas. Since the only area of technology in which costs are likely to stay level or even fall is that concerned with the processing of information, it becomes clear that the long-range approach to urban transportation must make full use of all aspects of communication. Study is required not only of the techniques that may be developed but also of the purposes to be served and the relationship between these purposes and the uses of land. This is a critical urban problem.

Also related to mobility is the problem of institutions and their character and role in the future urban pattern. Great design efforts have been devoted to the study of schools, churches, hospitals, and other institutions but generally on an assumption of little change from present basic character. As the urban pattern changes, will we reach a stage when traditional institutional forms must be substantially altered or replaced? What are the basic needs for institutions in our emerging society and how may they best be filled? What organizational and service forms are likely to emerge, and how may the transition from traditional forms be accomplished? Is the optimum scale of service as

large as the shopping center, or do we need a finer grain, to bring services more effectively in contact with those to be served? Can mobile clinics, for instance, provide a level of geriatric service that would free a growing number of costly hospital facilities? Much has been written of the social importance of the British pub and the store-front social unit in the New York slums; are these indicators of an unfilled level of need, or are they only the physical expressions of human frustration caused by obsolete physical patterns, comparable to the flourishing funguses on a dying tree?

A different set of problems stems from the emerging phenomenon of the large urban development project. In the period following World War II, there has been a significant change in the character of urban building operations in favor of the construction of large projects by single large organizations within a relatively short period of time. This is true for shopping centers, industrial parks, outlying residential communities, intown office complexes, and urban renewal projects. The trend seems certain to continue in the future, with the result that an increasing portion of our total urban environment will take the form of large projects for which the land development plans, building designs, and details of controls and financing will be worked out by strong and resourceful entrepreneurs as a unified package. Associated with this trend is an increasing industrialization of construction operations, a rapid rise in the potential for innovation, and a growing shift away from the traditional organizational structure maintained in the development fields during many years of craft building and urban growth by random accretion. The evidence is clear that few architects and planners, on the one hand, and few of those associated with guiding or regulating the building process on the other hand, are prepared to handle the full range of opportunities and responsibilities involved in the new operating scale. Even less do they, or the general public for whom the projects are designed, fully appreciate the degree of environment change that is likely to result from these scale changes.

This is a long enough list of problems. Selected at random, they have two important things in common: (1) their concern with broad aims and objectives rather than detailed engineering calculations, and (2) their difficulty. Yet honest frustration is preferable to the false security of irrelevant concreteness. Too many who undertake urban planning research slide off into the security of the traditional disciplines, carrying with them the limited foundation and other resources that have been allocated to this field. They are perhaps too influenced by a desire for solid scholarship and the respect of their academic colleagues.

As time goes on, the pressure of urban problems will be so great that most of the traditional disciplines will be pulled into the field in strength, and their key men will surely make more rapid progress than a few retreaded planners who have borrowed their methods for small and safe assaults on exposed bits of the problem. It is for that reason that this paper has treated rather summarily the vast bulk of scientific and engineering research associated with what I have called the construction function, although it is there that specific jobs are opened up, immediate profits made, and funds made readily available for research. I have been content to urge that there be less irrelevant concreteness and more running around end on construction problems, so as to gain for design the full benefits of scientific advance now screened out by the customs of engineers and the

prejudices of administrators. These intervening barriers must be broken down.

More important for our professions in the long run are the complex problems associated with the function of design. It is therefore essential to start to work at once to identify these problems in clinical terms and document their importance, for we need to attract to them the very best scientific manpower. Such men are challenged more than put off by difficulties, if they are convinced that they can make a contribution that is both useful and used.

. . . DISCUSSION OF MR KELLY'S PAPER ON PLANNING

George B. Cressey, Department of Geography, Syracuse University

I have always stood in awe of the scope of architecture. You are expected to be qualified to deal with a very wide array of problems, the strength of the beam which keeps the ceiling from falling down, the texture and color of the walls, the floor plan which enables rooms to be used for various purposes, and so on. I must say, however, that these conference papers leave me somewhat dissatisfied. I am to talk about planning but I am not a planner; I am merely a geographer. My function professionally is to deal with the inventory and evaluation of the items which go into planning, on which somebody else has to make decisions.

One of the reasons why I came to Ann Arbor is that some weeks ago when I received the documentation, I was intrigued by a little piece of blue paper which reads as follows: 'Architecture is concerned basically with space. The optimum arrangement and conditioning of space for all kinds of human activities.' If I were to engage in a commercial, I would say that is an excellent definition of geography, too. But what I have been hearing today leaves me rather empty and dissatisfied, because so far as I am concerned it doesn't seem to have its feet on the ground. Too much of it has been in a geographic vacuum. These things we are talking about exist in space, and I presume that we are concerned with the organization of space; not only within four walls, but all around the globe.

As a geographer I am concerned with the fact that space differs, that the places where man lives are highly unequal, and that the world which we inhabit and the world which we don't inhabit has personality which varies very widely from location to location. Therefore, the research on and the management of space has to begin with an evaluation which I haven't heard referred to, although I am sure my colleague Dr Lee will be talking about it, namely the factors of the environment.

My remarks can be summarized in one sentence. The world differs enormously in desirability, and if we are to design this space properly for man's use, we must recognize this variation. This is true not only in cities and in counties and in states, but in nations as a whole -- the world around. We are concerned with the management of space. We are interested not only in a building or in a project or in the renewal of an urban area or a county, but in the design of the entire United States. We do not stop there because we are

concerned, I take it, with the design of the whole world. There are no longer any barriers or walls which separate mankind.

One small aspect of this management of space which concerns me particularly has to do with the control of water. If the chairman had provided me with an introduction, he might have indicated, among other things, that I have been living a good many years in deserts. I have been wandering most recently in Arabia, Iran and the deserts of the Near East, and before that for five summers in Mongolia. Now, obviously in the deserts water is a matter of prime concern. But it is also apparent to most of us, I am sure, that water is coming to be a matter of critical concern even in humid lands of the United States. We are coming to the place where in Western New York State the major value of the Erie Canal will not be for transportion but to supply irrigation water from Lake Erie to the western half of the State. And so in our design, whether it be cities or space at large, certainly the use and command of water is one of the critical things we are interested in.

Since my profession leads me to think of other parts of the world outside the United States, I am very much concerned with planning in the Soviet Union, where I have been on several occasions. And since much of my professional life is concerned with all of Asia, let me refer briefly to planning in the Soviet Union as it relates to planning in the rest of Asia.

We in the United States are under a considerable handicap when Burma or India or parts of under-developed Africa turn to us in the West with a request for planners and for advice on development. Southern Asia and all of Africa and most of the world is in a hurry to catch up with the West as rapidly as possible. They call for planners. The USSR has gone a long way in planning, not only for structures but in an overall development of the national economy. When the peoples of Asia look for planners they come to the United States and ask who we have who is skilled in overall planning. We say, 'well we have a laissez-faire economy, these problems all take care of themselves automatically.' When they go to the Soviet Union the Communists say 'Yes, we have planners who know how to design an overall economy, and here are brilliant examples of our results'. In a material sense they certainly have something to show.

I am concerned, too, over some of the mistakes that Russia has made. I have visited some of the large steel mills and other planning enterprises of the USSR and have been aware of the major errors which the Russians have committed because they do not first complete the inventory. It is obvious, but too often overlooked, that you cannot plan until you have finished the inventory. In their haste to design great industrial enterprises and cities and so on, the Soviets did not have time or wisdom to have first finished the analysis of their assets and needs. Therefore they have wasted literally billions of dollars putting steel mills in the wrong places, of the wrong design, and so on. That is equally true in the United States. We cannot plan, whether it is for urban or rural development or for the nation as a whole, until we have our inventory fully in hand. This analysis, although we have done a great deal in recent decades, we still do not have.

I want to raise one other question which is quite outside my competence but which bothers me somewhat. I live in a city which is currently interested in urban renewal. Through the press and by other

means we are being told that the city should bond itself for rather large sums, clear out slums and do a lot of things around the decaying periphery of the central business district. When you ask why, you get rather vague answers but when you pin these answers down outside of generalities concerning human welfare, it is said, that we must preserve the tax structure in the central business district. In other words, our proposals for very large bonding really come down to preserving the investment of certain department stores on Main Street, and the tax which they provide to the city. One device is to put up a lot of parking structures, specifically to build two 8-story parking garages where, I suppose, you will have to pay fifty cents to go down town and park your car so you can shop in the department stores. But, in contrast, you may go to the new outlying shopping districts which are on the periphery of the city and park your car free and do all your shopping. Do we still need central business districts? Maybe this is a heresy, but at least we in Syracuse have not been told why we should preserve a down-town commercial core.

If my remarks on planning have any value it is that I am concerned with the inventory of what we have, and where it is, and how much, before we can go ahead and plan. I take it that if the definition on the blue paper is true -- that architecture is concerned with space -- we need to broaden our horizons and not only concern ourselves with structures and institutions but look at the entire nation and the entire world.

. . . SECOND DISCUSSION OF MR KELLY'S PAPER ON PLANNING

Henry D. Whitney, AIA, Planning Engineer and Consultant, New York

Research in City Design - A Suggested Program.

At this point architectural research seems to be a very thoroughly defined subject. Therefore I will go on to suggest a field where major efforts may well be expended, without too much consideration of whether the activities should be called basic research or merely technology. It may be sufficient for the moment that these efforts are vitally needed.

Mr Kelly's statement appears to omit no considerations of importance. Architectural research in the field of construction promises great advances but faces great obstacles in the form of codes, budgets and conventional practice. He has focused our attention, therefore, on design and particularly on the desirability of clearer design objectives.

I was much impressed, also, at the red flags he has planted. He warns against confusing measurability in a research subject with its ultimate importance and against accepting two architectural fallacies which are extremely popular today. The first consists in the worship of structural considerations to the virtual exclusion of others equally necessary for a rounded conception of architecture. These could well be the proper use of land and the needs of the group in the community - in distinction to those of the individual client.

The second fallacy consists in deifying the

intuitive or individualistic approach to design in which science is precluded from playing any real part unless its findings happen to agree with the designer's personal intuition.

Mr Kelly's statement of the need for better and clearer design objectives is reinforced everywhere in American culture. Our automobiles are good, powerful and perhaps not overpriced in view of the level of general prosperity, but their design is chaotic and irrational. Our radio and TV programs have great variety of choice and are expensively presented, but the program content lacks any consistent cultural or artistic intent. Our cities are prosperous and full of new buildings but they are a dangerous, unhealthful, profoundly unfunctional in many of their central parts and visually unattractive. In almost every department of our national life we are strong, industrious, optistimic, well-meaning, and withal, culturally misdirected or undirected.

Almost everywhere we need better and clearer goals. Almost everywhere we need a greater sense of meaning and of design in our lives and in our environment. Our national life focuses in our metropolitan areas which have been growing and are continuing to grow at the expense of the rest of the country. It is in these urban areas that our need for design objectives becomes the most apparent.

Let us as architects, engineers and scientists collaborate, therefore, in research aimed at explaining how to overcome the fearful physical condition of our cities. Let us as architects take the lead in launching a major program of research in city design objectives. Whether the flight to the suburbs caused the slums back in the city's center is of secondary importance. The fact that the close-in areas of cities have been allowed to grow unlivable for families with children has certainly meant that vast numbers of people in and around cities have come to live in the wrong places, from the standpoint of the city's total health and welfare.

The poor are consolidated in the cheap rental accommodations of the decaying center, causing the municipal government extra costs of police, health and social services. The middle income groups commute from the outskirts where costly new public facilities have been provided for their use and where much of their tax-paying ability is lost to the central city. Freed from the week-day burdens of country dwellers seeking and leaving the city and from the week-end burdens of city dwellers seeking and returning from the country, our metropolitan traffic problems could be solved without resort to so many of the new throughways which slash the city to pieces and blight the neighborhoods they penetrate.

In other words, if we could find ways of gradually reversing the flight to the suburbs and making cities livable again, we could put an end to many of the ills and frustrations of the modern age. The crime, sickness and delinquency of the inner city could be mitigated as would the inconvenience, irrationality and expense of much suburban life and the general waste of money, resources and human spirit which unlivable cities entail for everyone, high and low.

First we must have a new conception of the planning process. Planning has been sold to the country but in a rather negative form. The master plan in a typical city is an admirable document as far as it goes but, aside from its use as a framework for a

capital budget, it is predominantly a method of regulating what people are going to do anyway, when they get around to it. Instead, we need a type of planning which is more dynamic, conceptual and positive, which uncovers latent possibilities in city land-use and makes new things happen by pointing out their economic and social feasibility and by working out methods for their three-dimensional accomplishment.

Along with this should go systematic assistance by the architectural profession to Congress and to the Federal authorities in developing better administrative and technical procedures for the urban renewal program which at present constitutes our chief means for progressive city rebuilding. The following research projects are submitted as component parts of this enterprise:

. New potentials for urban land. We should sponsor the study of better patterns of urban land-use because most of the important considerations involved are typical. Now city development tends to take place in rings, with luxury housing near the center, circles of slums and blight a little further out, a fairly dense ring of lower and middle-income dwellings beyond that, sometimes another band of low-density industrial blight and finally the suburbs and exurbs surrounding everything. There is much evidence to support a gradual shift from these rings to accommodate different income and other groups in elongated segments of various sizes which would radiate from the city center and in which different groups could live side-by-side all the way out to the periphery, This could break down the consolidation of slums, blight and potential blight in the city's most conveniently located, and therefore its potentially best areas, without arbitrarily uprooting the poor or without playing Creator in regard to the proper sections to be inhabited by the other groups in society.

. Minimum design objectives in urban residential neighborhoods. We need to think in terms of the minimum physical requirements for residential permanence of various types of families. For instance, we should study what families with school-age children find, or think they find, in the suburbs, where living is popularly supposed to represent the American ideal, and do our best to fulfill at least some of these basic needs within the city. Cities used to be composed of town houses with private yards. When apartments began to replace individual houses the suburbs began to grow. Many advantages associated today with outlying areas could be provided in tomorrow's inner-city through the mechanisms of urban redevelopment and renewal at no greater cost for land or buildings than for conventional developments containing nothing but apartment towers.

. Minimum design objectives in suburban residential neighborhoods. Outlying areas are being developed with tract-housing by large homebuilders at the rate of a million houses a year. Besides their extra ordinary visual monotony, these environments waste land, lack privacy and tend to be socially and economically stratifying. They strain public services and traffic and transportation facilities and may end by being unstable from a real estate standpoint. This is a typical condition throughout the country in which creative architectural and social research are much needed.

. The elevator apartment as a residence for families with school-age children. The last ten years of private and public housing experience with this type of structure is in need of field analysis for the benefit of the urban redevelopment program and future

city building generally

Residential density. Many more graphic studies are needed to relate the number of families per acre more closely with the extend of land covered by various types of dwelling structures and their various combinations. As many sins are committed in securing low densities as in securing high ones, so inadequate are the old formulas.

The city should be the special province of the architect. His profession depends chiefly on urban construction. He has built large parts of present cities and he could build larger parts of future ones.

Architecture is the art and science of space production and city is the environment in which space is most at a premium and where its proper location and ordering is most needed and appreciated. We should not be surprised, however, if ready-made clients do not crowd forward with the request that architects design new city environments. We have paid too much attention to individual buildings recently and not enough to groups of buildings in the city context. Now we must make this contribution first on our own account. We must identify the vital research needed by the city if it is to become livable again. We must do this as a public service and for the good of the profession as well.

SECOND DAY ASSEMBLY

Walter A Taylor, FAIA, Chairman

(Taylor) By way of opening the general discussion it may be appropriate to hear a brief review of recent Institute activities in architectural research through its committees and staff.

(Campbell) While the Committee on Research is initiating what we hope will become a comprehensive and orderly approach to architectural research, a certain amount of it has been carried out for many years by AIA headquarters staff. It would be wrong for us to assume that no architectural research has been accomplished. It has tended to be project research--of which we have had a basketfull. We have devoted considerable effort to information services concerning architectural research. We are starting two programs. One is the Building Products Register. It is a subscription service, a means whereby there can be some evaluation of building products. At the moment we can limit it to that but there's no limit to the hopes for future development of this service as an information medium for our profession and for other professions. It is an attempt to enable the architect and others to cut through the mass of advertising.

Another program is the Index of Architectural Information, which is not yet under way. This will be a comprehensive index to references on architecture, building products and engineering. These two projects are aimed at better technical communications. We certainly are involved also in research in hospital buildings and educational facilities.

(Pawley) The AIA National Committee on School Buildings has been mentioned. It has a number of activities which, while they are not primary research, add to the knowledge we have about this building type. We regularly publish material in this field through the AIA Journal and the same is true of our Committee on Hospitals. The latter has a more fundamental study just getting under way, a collaborative research program with the American Hospital Association. This is supported by a $300,000 grant from the government and we've just found a director for it. The first project will be an application of operations research in the planning of a building type, the hospital, possibly using this kind of analysis for the first time. We are viewing this with mixed feelings of scepticism and delight. We hope that it will cut down some of the trial-and-error work of the architect. It is in no sense an attempt to replace him by an electronic brain. There are other committees in the Institute with many different functions and areas. Some of their work will also, I believe, qualify as research.

The staff of the AIA Department of Education and Research has been busy in the area of publications. Some of these appear in our journal in the form of technical reference guides or building-type reference guides. A great deal of our study has been within building types of one kind or another. This is a natural cumulation of what is known in an area and attempting to find out what the client thinks should be done about his particular type of building--what architects have done with this type of building in the past, and

opinions on the future. They usually include selective references which indicate past efforts.

The technical reference guides are parallel attempts to compile material in specialties such as acoustics or lighting which are not limited to a single building type.

We have had a 6-year joint study with the Illuminating Engineering Society and another group called the National Council on Schoolhouse Construction on the subject of school lighting. This is highly controversial--the IES has just recently come out with recommendations for some extremely high levels of illumination on which we are reserving judgment. There will be a document published -- it will state the total picture as we see it: the point of view of the engineer, the architect, and this other national group which represents the client, the school administrator and educator. I have described this as an example of the kind of work we now perform. (For additional comments by Mr. Taylor on AIA activities, see page . --Ed.) *

(Ehrenkrantz) It is not necessary to determine limits between basic and applied research, but the end-product should be kept in mind. Problem-solving for architectural projects does not take material directly from pure science. The middle ground is a fruitful field for basic architectural research.

In some British experiments mathematicians determined that bricks should be made in 11" and 7" sizes to produce 1" increments in building dimensions. More useful results might have been achieved if this research had been done by mathematicians with the help of architects or vice versa. It is immaterial which group is the prime researcher so long as results are integrated.

(McLaughlin) We should use other disciplines to help determine the kind of man the architect should be. Present curriculum is largely limited to technical subjects. Major problem is to find properly trained personnel and also people who have the born desire to engage in research.

(Bannister) The Florida Foundation, to which all segments of the building industry belong, investigates building problems of mutual concern. Financial participation by architects will be necessary before much can be expected in the way of architectural research. Architectural research is not a new area, In late 18th Century France a group of architects met regularly with the King to discuss architectural problems.

(Alschuler) We should do something to encourage potentially good architects to enter the profession of architecture.

(Severud) How should new partners in a firm be treated? What happens to good will of a retired partner? Preparation for practice as a principal should be more formalized.

(Alschuler) There is opportunity for a new type of consultant, namely, a consultant for architects.

(Kelly) The foundations are suspicious of architectural problems so the schools tend to dress them up as city planning problems which have less difficulty

** (Remainder of this meeting is topically reported from rough notes, tape recorder was not in use.-Ed.)*

getting financial support (city planning itself has no easy access to funds).

(Pawley) Someone referred to well-established technical standards, but those in the lighting handbooks, for example, may differ from country to country on the order of 3-1/2 to 1.

Comparative studies of different solutions are not possible to the extent desired, on the clients money. The relation between public demand and public support or research is illustrated by the flare-up in interest in fire safety resulting from recent school fires.

(Foley) It is necessary to provide motivation for architects to do research. There should be no stigma for non-practicing architects doing research.

(Hauf) I oppose the idea that all teachers should be licensed--in either the architectural or engineering field.

(Campbell) Although architects generally avoid becoming known as specialists, they usually have specialists on their staffs.

(Horowitz) We should not be apologetic about lack of research--a great deal of research is done in the industry as well as in architects' offices which does not look like research when compared with so called scientific research. There are some 500 trade associations that operate on the national level, all of them doing research of one kind or another.

(Dietz) I agree with Severud. We are ignoring the best available laboratory--existing buildings.

(Severud) I would like to have my firm in the foreground in the use of new materials but very seldom can we use any material not time-tested. This policy does not delay progress very much because any new material worth its salt will soon be tested by somebody.

(Swinburne) Evaluation and examination of completed buildings is good but should not be confined to problems of maintenance and custodial care.

(Taylor) A great need is to know how people actually use housing designed according to HHFA or other formulas, compared with the intent of those formulas. We need realistic space studies.

(Pawley) Chambers in Mayan pyramids are the same size and shape as reed huts built outside--a room is a room.

(Herrington) The ratio of body volume of the fly and his essential living space is about the same as for humans.

(Hauf) Efforts were made in New York City to determine whether kids will cause more breakage of small panes or large panes of glass. It was finally ruled that panes could not exceed 90" in perimeter because over that size the custodian would have to hire union help.

(Reid) Much of the machinery already exists for doing research, only slight changes are needed to properly direct it. We need more help from psychologists and sociologists.

(Reicken) I have been impressed with the range of problems discussed and with the straight-forwardness of the discussions. The conference should discuss how the gulf between behavioral sciences and architecture can be bridged.

(Larson) We should link research and development because the latter implies a goal. The development of any form is not complete until it is eliminated or superseded by something better. We can have research on research, on design, on marketing, on products, and on elimination of the obsolete.

(Taylor) In tackling any subject as broad as architectural research it is necessary to break it down into its component elements for detailed study and then attempt a synthesis. Therefore since this is a working conference I believe we could make the most progress if we split up into smaller groups at this time, according to the Program. Each group will have a recording secretary who will present a written report to the entire assembly in the morning. Finally we will have another panel discussion with all participants taking part, to pull the pieces together and try to lay down some underlines and guidelines.

REPORTS OF DISCUSSION GROUPS

Report A

(ARCHITECTURE-SOCIOLOGY-ENVIRONMENTAL HEALTH)

Herbert H Swinburne, AIA Chairman
Alfred S Alschuler, Jr, AIA
Glenn H Beyer

Eric Pawley, AIA, Secretary
Eugene George, Jr., AIA
Douglas H K Lee

Our initial statement is in the form of three brief lists: of reactions to comments of various conference participants--a pessimistic one--an optimistic one--and a few significant statements we heard:

pessimistic:

Pond - architects are not capable of research

Hauf - architect is not a key figure; skeptical of bureaucratic apporach

Ittelson - you can't plan research; no team or project research is any good

Swanson - social scientists have nothing for architects

Cressey - dissatisfied with conference progress

Severud - can't get finest brains for the job

optimistic:

Hauf - need a bureau of research information; include economics

Reid - make case studies of completed work; put the client in the creative act; public should share research results

Dietz - collaboration on whole structure

Severud - value of field investigations

Ittelson - don't separate disciplines study completed work

Richardson - client-interview technique communication evaluate worth of completed structures

Beyer - values

Swanson - architect as businessman-management--sales

Cressey - can't plan without inventory; study space

Herrington - architectural forms induce behavior which can be researched

Lee - it can be done!
analogy of nervous system to research organization

significant statements:

can't plan without an inventory

value concepts

architectural forms induce behavior

architectural research can be done

most frequent statement:

evaluate worth of completed projects through case study method

most positive-negative statement:

the social scientist has nothing for the architect

Our study group agreed that architectural research is not only desirable but mandatory for the maturity of our profession. Rather than an academic, committee-spawned definition of architectural research we accepted a simple statement of the purpose of architectural research: to create better architecture, meeting all requirements of our projects--functional, aesthetic and economic. In this we need the help of behavioral science skills and techniques.

We agreed that studies in the area of economics are most important--keeping in mind the spirit of Edmund Burke's thought: "Economy does not imply penury--it consists in selection and is a distributive virtue. . ."

We believe in the necessity:

of studying influences of environment on behavior--sensory, emotional and psychological

of better understanding of function--of actual uses of spaces, not the names of rooms

of recognizing the influence of social values on how people react to architectural environment--as beholders and users

of studying the barrier functions of architectural forms

of studying plan efficiencies and resulting work-loads on occupants

of studying the all-important area of communication

The concept of "a key man" was rejected. Later the concept of "a leader" came to be

suspect and was replaced by a hope for an inspirational leadership.

Similarly the "team approach" was discounted somewhat by voices of bitter experience which indicated that it has "problems."

It was agreed that the leadership must be vigorous, capable of decision (when a project is ripe) and not unsophisticated in interdisciplinary communication.

The values of a governing board and/or an advisory committee were explored. It was our consensus that a good and versatile director of research should evolve his own program with what might be called inertial guidance only (to get it off dead-centers). This might be from a cross-fertilizing group similar to an enlargement of the steering committee which planned this conference. Furthermore, we agreed with others that it is important to stop separating architecture from sociology from environmental health, etc.

The need for trained research personnel and for methods of training were noted as acute factors in this whole area.

It is of utmost importance to the health and well-being of research that it be given a longer life than any committee.

To restate from the summary notes--we have agreed upon the following general policy statement:

Architecture today does not have the same research support or activity as other professions. It is greatly needed. We are convinced that it can be provided. Central stimulation is required--along with inspired leadership.

Report B

(ARCHITECTURE-SOCIOLOGY-ENVIRONMENTAL HEALTH)

Dr Donald L. Foley, Chairman
Walter E Campbell, AIA

Byron Bloomfield, AIA, Secretary
M Allen Pond

The members of this group found few areas of disagreement. We felt that architectural research certainly was a much needed development and one that should be cultivated - for that reason came up with five recommendations. We concentrated on how the entire problem could be handled rather than on specific projects that could be researched.

I. With the increasing reliance on the behavioral and physical sciences for the fulfillment of architectural objectives in the design of buildings it is urgently recommended by this sub-committee that a method of communication for pertinent related information be formulated and inaugurated. This could take the form of an abstracting service to encompass information from related disciplines that have bearing on the design evolution of architectural projects and on architectural research in general.

(a) The above service might also assume the functions of a central architectural research intelligence agency by collecting and disseminating status reports on current research projects.

II. As a means of identification of resources not presently utilized in the programming and planning of buildings, the following research project is proposed:

(a) A team of qualified individuals from the major disciplines involved with architecture should inspect completed buildings, evaluate accomplishments in the light of original objectives, then reconstruct as many of the influences that were exerted during the programming and planning phases as necessary to evaluate their effects on the final result. Evaluation of several projects could be expected to provide the basis for a committee to identify many areas of needed architectural research, areas of research that could be performed by the behavioral and physical sciences within their own disciplines, areas of joint research, and also to identify current practices that could be better performed by taking full advantage of existing knowledge.

III. The AIA Committee on Research should perform the function of stimulating architectural research efforts. The stimulus should encourage schools of architecture to utilize existing staffs and facilities more fully, and identify areas of desirable additional knowledge useful to the architectural profession that could be researched in other fields.

(a) To adequately perform this beneficial function, the committee should be reconstituted to include representation of the basic sciences on the committee, thus taking advantage of the necessary interplay of the sciences and research methodology.

IV. As an essential ingredient to the competent conduct of future architectural research, steps should be taken at this time to encourage and assure adequate training and numbers of architectural research personnel. This training should include apprentice experience in ongoing research; the availability of graduate students or other apprentices in turn provides a source of research assistants.

(a) Stimuli are needed which will encourage architecturally trained individuals to pursue further education, especially in one or another branch of science. An important stimulus would be financial assistance in the form of scholarships leading toward doctoral degrees in more specialized disciplines. Additional forms of assistance to universities to provide traineeships, research facilities and stimulation for research should also be explored.

V. As architectural research develops into a well defined field of endeavor, a center for advanced study would perform a beneficial service to all groups within the realm of architecture. With proper financial support, such a center could give experienced investigators the opportunity for extended advanced study and development in conjunction with colleagues from adjacent specialties. Within an atmosphere of this nature, the benefits could be expected to be at least two-fold:

(1) findings of research conducted at an advanced level by experienced researchers would directly benefit individual practicing architects in the performance of their professional activities, and

(2) provide a stimulus and motivation for better architectural research personnel.

Report C

(PLANNING-STRUCTURES-PSYCHOLOGY)

Harold D Hauf, AIA, Chairman
Dr Albert G H Dietz
Guy E Swanson

Burnham Kelly, AIA, Secretary
Ezra D Ehrenkrantz
Gene M Nordby

We were principally concerned with the hope of finding an area in which we might get what we could call conference-wide agreement on at least some nucleus in statement. Let me explain to you how we reached this point of view and then let me try on you the statement.

Recalling first of all what we talked about yesterday morning--the feeling that when you come to areas of land-use planning, areas dealing with the economic location of uses and other things of this sort--which have been properly or improperly taken up largely by the city planning profession --I thought we could simply say that these are being granted money, that there are major universities at work on them and simply for strategic reasons we might worry too much about them here. Having said that much then, we can discuss some problems which seem basic to any progress in research in the field of architecture.

One element of this problem is that architecture should define and understand and publicize what it believes to be its own area of research basic to it, although we would admit that this is not likely to be considered basic by at least the exact sciences. This area is fairly well described in Merton's paper in terms of the middle ground and we thought that one of the main reasons for trying to focus attention and understanding on it, was that it would be important to reverse the expectations of other scientific fields, of the foundations, and of other potential sponsors with regard to architectural research which, in our humble opinion, at the present time is low. The expectation of other people when they hear that architects are undertaking research is that they are going to get a lot of brilliant talk, maybe a few very clever designs, but little that can be considered substantial in the form of research. It seems to me that this is unfair to the profession and that the profession has its field and that by attempting to say what this field is and how it will work, we will be able to put a banner up with which eventually we can reverse these expectations and get more cooperative assistance from serious-minded scientists in other fields as well as sponsorship. So this is one problem--definition.

The second problem is: who does this work? Anyone who has done any research work or who has tried to get funds for research work knows how important this problem is; and anyone who has looked at research in the architectural field knows how few people there are who have the qualifications, the training, the skills, or the interest to do what is essentially architectural research. I wish I could have a nickel for every school I have visited where the head of the city planning department has said to his staff, "We better have some research. Now who will volunteer to do research for us this term?" And some member of the staff having thus been tapped, tries (1) to find a subject, and (2) an area, and then (3) a sponsor, only to find out (1) that he doesn't know anything

about doing research, and (2) the sponsor immediately recognizes this. So a crucial problem in attempting to develop an architectural research field is obviously to concentrate on where will the men come from who will do this work; how will we train them; how will we nourish, feed them, and keep them in an essentially architectural research area--keep them from straying off to what seems to be, at the present time, more lucrative research areas in other fields?

Some of the problems we have already mentioned and have been mentioned by the profession before... apprenticeship credit, little things that keep bright people within the profession and still in research positions.

The group wanted to make clear a fairly simple distinction on the research front, a distinction between research and the kinds of services the profession would be expected to provide to its practitioner members--such as the Building Products Register and the Index to Architectural Information and so on which are normal association services to practitioner members.

These are not research but include research services--the business of providing abstracts of important papers, of making translations from other languages and from other disciplines, and otherwise serving what you might call the learned society aspect of the architectural profession. Having said this much, we wanted to counter one notion that was raised here, namely, that research is expensive. This is, of course, true. It is proper to point out that dollars are large when you talk in research terms but we wanted also to make it clear that from an over-all point of view research is exceedingly cheap when you take into account all of the costs of construction, operation and maintenance. In the life of any kind of a product, research is certainly one of the cheapest investments in terms of the total return.

And now I come almost to the statement for which I have been preparing you. We were torn between trying to state a series of projects, proposals if you wish. I, in my own paper, listed several, almost in passing--one of which was a $100,000 three years' study for the Rockefeller Foundation; another one which is expected to be a major effort on the part of the three of us in different disciplines at MIT and may lead eventually to an expenditure of several millions of dollars on demonstrations at the urban scale. But we concluded that it would not be appropriate or possible in this gathering to go into project-by-project recommendations or pat-on-the-back approval or any reasonable type of listing or priority rating. Indeed, this is probably not the function of this group, anyway. It seemed to us that what would be more important would be to make, if we could, a statement of what seemed to us to be a very general opinion in the group while we have here in one room a number of people from different research disciplines, a number of people who have heard what we have had to say to each other, and to pass to the AIA and eventually to the profession, a fair consensus statement. It is meant to be neither exclusive nor inclusive--it hopes only to point to an area on which I think we have a high degree of agreement, and to define a little more than Mr Pawley did in his report the position that the profession ought to take at the moment with regard to research

STATEMENT

There was a high degree of unanimity among those present at the conference - including men from other disciplines, men already engaged in architectural research, and practicing architects--that there is a basic area of architectural research that deserves major attention at the present time.

This area was described both as an area of clinical research and as a middle ground between the more specialized disciplines and the practicing architect. Research in architecture, as in comparable fields of professional service such as law and medicine, should be devoted both to the advancement of knowledge and the enrichment of service to the public. Progress may be made in stages, first ordering the existing knowledge, then pursuing solutions to questions now unanswerable, and finally adding to the store of fundamental knowledge as well as making withdrawals from it.

Most of the research work now in progress in architecture is of an applied or developmental nature, since financial support tends to be concentrated on projects which explore detailed construction problems for industry or government, and since the projects basic to architecture tend to be more complex and less subject to investigation by conventional methods.

It is important for architects to declare their concern for the more basic area of architectural research, to speed the development of appropriate research techniques, and to open the way for specially qualified research men to find a career of respected service within the profession.

Report D

(PLANNING-STRUCTURES-PSYCHOLOGY)

Albert H Hastorf, Chairman
Dr L P Herrington
Karel Yasko, AIA, Secretary
Eugene F Magenau, AIA
Myle J Holley, Jr

We were assigned the following areas:

1. Planning
2. Structures
3. Psychology

Our discussions encompassed the areas of Planning, Structures and Psychology, and others as well, but with the exception of our Proposals I and II below, we found it impractical to make specific recommendations. We share the strong conviction that there are a multitude of researchable problems. We feel however, that neither a wise nor even an orderly selection of these problems for study is feasible at this time. The architect has strongly stated his need for research directed towards knowledge of "MAN." We sympathize with this need but sense it to be so broad that the necessary questions are not readily framed.

The first of our proposals is relatively insensitive to the above-mentioned limitations. The second would not only be a significant effort in and of itself, but we hope

would serve as the opening wedge in the clarification and specification of the issues on which the knowledge and methodology of the behaviour sciences can be brought to bear on significant problems.

Our proposals are as follows:

PROPOSAL I

This relates to information gathering activities of the architect.

We wish to record our conviction that the ultimate solution for each design problem must remain with the architect directly concerned. There can be no retreat into standardized handbook design. The comprehensive criteria developed in a recent Cornell study do not obviate the design function as related to a specific home for "senior citizens."

However, it can serve as an efficient source of data defining the general nature of the problem and indicating the areas where more detailed information is needed. The accumulation of such organized information and acquired knowledge gives the architect a head start in his information gathering task. This should provide him with certain guide lines for the further exploration of the specific problems through conferences with the client.

Our proposal is for a program leading to the collation of general information of the kind provided by the Cornell report, bearing on each of the most frequently encountered design situations. (For example, the AIA Plant Studies.)

We would like to point out that the development of information of this kind closely parallels the already initiated effort in the field of building materials.

We think it important to recognize the significant contribution represented by this kind of effort and we feel it would be a mistake if such effort was underrated because of lack of glamour.

Any technique for increasing the efficiency of information gathering should be strongly encouraged.

PROPOSAL II

This proposed research project is concerned with the application of behavioral science methodology to an analysis of the professional behavior of the architect. We urge that a relatively large scale study be undertaken concerning a number of questions including:

(1) the public's image of the architect,
(2) the architect's image of himself,
(3) characteristics of people recruited into architecture,
(4) effect of training on the architect as a person,
(5) analysis of the architect's role conflict (art vs. market place).

In addition, complete case histories of architect-client relationship in the development and completion of architectural projects would be required.

At this point, we should make mention of the most significant survey accomplished by the AIA in its "Architect at Mid-Century." Although we are firmly convinced that a number of fruitful hypotheses could be derived from that survey, the research project that we envisage would be quite different. Probably the simplest way to communicate the type of research we have in mind is by reference to similar studies that are now being published relative to the medical profession.

We emphasize our conviction of the importance of the proposed research. It should open up the entire inter-action between the behavioral sciences and the practice of architecture, thereby identifying areas of significant research potential and, in addition, permitting the necessary formulation of meaningful questions.

Report E

(ARCHITECTURE-SOCIOLOGY-PSYCHOLOGY)

Robert W McLaughlin, FAIA, Chairman
William H Ittelson
Harold Horowitz, Secretary
John Lyon Reid, FAIA
Paul Zucker

The first section of our report includes certain general concepts, the second section some examples of research in the area that we are talking about (not in the sense of priority but that they help describe the area that we were concerned with), the third section discusses the problems of establishing contact between the disciplines that we were concerned with, and the fourth has some general principles about education in architecture with respect to the fields we were talking about--architecture, sociology, and psychology. We also did some speculating on what our report would be like if Dr Merton had been with us.

I. GENERAL

In discussing the problem broadly, the term "architectural research" seemed to impose severe limitations and "research for architecture" was adopted as a phrase more meaningful to the group discussion as it appeared to offer freedom for individuals in other disciplines to contribute research to the development of architecture and freedom for architects themselves to move outside the usual lines of architectural practice in exploration of problems of concern to them. The phrase "research for architecture" seemed to be properly descriptive and did not create the feeling of a rigidly defined area.

The group then proceeded to discuss the impact of architecture on man and raised many questions on how the work of architects influences the public both psychologically and sociologically and how, in turn, the public influences the architect and his work. There was much discussion of problems architects have in working with their clients in the exchange of information concerning aesthetic and emotional values. It was felt that research for architecture by psychologists and sociologists would include investigation of measurable differences in awareness and reaction to environment and that such findings might be of value both in the design process and in communication. Such research was felt to be possible although very difficult. The difficulty was discussed in detail with questions being raised concerning the adaptation of people to adverse environmental factors which might produce variations in measurement over a period of time. Other limitations of sociological and psychological research that were discussed concern the selection of criteria to be used and the evaluation of criteria. The problem of establishing proof of criteria was regarded as being very difficult. The

group indicated that the expectation that the research of sociologists and psychologists would not lead to rules, but rather, broad principles that would assist in advancing architectural concepts as well as assist in the problem of communication with clients and the public on matters of aesthetic and emotional values.

In concluding this phase of the group discussion a consensus was reached to present the Conference with the following statement: "The architect believes that his work has an impact on the experience of people and feels that this is his most important function. He would like to learn to measure and evaluate the impact of his work."

With consideration given to the importance of the evolution of taste or fashion as distinguished from the basic concept of style and the influence of these on his work he believes that research by the sociologist and psychologist can assist him.

II. PROBLEMS FOR RESEARCH

The discussion group considered both general and specific problems for research on architecture by sociologists and psychologists. Many of these problems would be undertaken in collaboration with architects. The broad field of needed research was described by the following series:

- analysis of forces that have shaped architectural forms.
- how does architecture happen?
- to what extent does environment as created throughout history indicate evidence be found for conscious design effort.
- what part of conscious design philosophy is rationalization of an already determined form?
- how may the architect extend his knowledge of the degree to which environment can be planned?
- what are the crucial decisions and the points at which they occur in the evolution of an architectural form?
- what are the factors beyond the control of an architect in the evolution of architectural form?

Examples of needed research on more specific problems are:

- what are the constructed environments that have produced similar responses by peoples of various ages and cultures?
- what similar constructed environments are known to induce different responses by peoples of various ages and cultures?
- what can be learned by the analysis of these responses by sociological and psychological methodology?
- the methodology of the sociologist and psychologist are available to analyse the nature of the creative processes, identify creativity, and assist creative people in the use of the research results.
- study the rhythm of movement of people, of human behavior and emotional reaction under the influence of buildings, arcades and other construction forming boundaries of pedestrian traffic arteries.

The discussion group suggests the following as an example of specific research program that would involve a collaborative effort by architects, sociologists, and psychologists. The National Safety Council reports that accidental injury in the home is responsible for more deaths of infants under one year of age than any other

single cause or disease. The National Safety Council also reports similar findings for persons over 65 years of age. The proposed research would investigate the extent to which design and construction of the home contribute to the likelihood of accidental injury. When results of the research are known the integration of this new information on safety into the total design process would also require study. In this way a specific research problem yields data of broad generality. A program of this sort requires cooperation between many disciplines.

III. FORMING BRIDGES BETWEEN ARCHITECTURE, SOCIOLOGY, AND PSYCHOLOGY

The discussion group questioned the validity of establishing an overall plan for bringing together the three disciplines and felt that the key to this problem is in the personal relations between the particular individuals that might be called together on a specific problem.

The broad question of the impact of architecture on the public is regarded as a proper area of research for architecture, to be undertaken with the collaboration of the social scientists. In addition to the disciplines represented at this conference contributions can be made by economists, anthropologists and political scientists. The problems cannot be departmentalized within conventional professional lines. The planning of patterns of communication would vary with each group of individuals and research problem.

The discussion group proposes further consideration of this general area through a specific program, possibly a conference which would permit sociological and psychological problems to be presented to architects and in turn architectural design problems presented to sociologists and psychologists.

IV. TRAINING OF STUDENTS IN ARCHITECTURE

Regarding the training given to architectural students in schools, the discussion group agreed on the following principles:

- architects to be effective must have relatively complex knowledge and appreciation of sciences outside their immediate professional duties.
- architectural students must be brought in contact with sociological and psychological problems and the research that is being conducted on them. This should be done as early as possible during their training. The discussion group recognizes that architectural students tend to dislike and avoid abstract and theoretical ideas that do not have tangible physical form. Nevertheless, a serious effort must be made to give these students an understanding of the importance of these fields.
- Research in architectural schools in areas related to the social scientist can best be taught by the presence of faculty members engaged in such activities and who are able to gradually interest and bring graduate students into contact with their work and in this way teach them to appreciate the methods and contributions of such research.

Report F

(ARCHITECTURE-SOCIOLOGY-PSYCHOLOGY)

C Theodore Larson, AIA, Chairman
Dr Turpin C Bannister, FAIA
Dr George B Cressey
Walter A Taylor, FAIA, Secretary
Dr Stephen A Richardson
Fred N Severud

This report will doubtless take the record for verbosity and length and I am also sure that there is hardly anything in here that wasn't included in one of the other group reports. However, it may serve to strengthen and reaffirm some of those ideas.

I-Methods of Definition of Goals and Problems

Since most of the problems are essentially inter-disciplinary an essential step is a continuing series of inter-discipline seminars. It is necessary to develop a mutual understanding of the attitudes, approaches, and vocabularies of the various disciplines. Specialists in the various disciplines have first to learn to talk with each other. This type of exchange can be most readily arranged on university campuses. Each specialist finds that his terminologies may need modification. There could very well be special grants to schools of architecture to permit them to serve as host to cross-campus groups. Such groups could also serve as boards of review for local applicants for research grants. This general process could lead to a progressive clarification of the goals for research and design criteria for various building types and/or design objectives. In this evolutionary process individual leaders should not be originally designated. Each major participant should find this experience valuable for the approach to research in his individual discipline. This process also reveals the breakdown of the disciplinary labels which have heretofore prevailed. This interaction also is an antidote to the tendency of staff personnel in the subject institution to resist new ideas beyond their experience with existing buildings.

An extension of this idea to existing learned and professional societies by means of joint sessions would be similarly mutually beneficial.

This principle could also be applied to the programming of college buildings. In many such efforts the consumer or client should also be included.

The modus operandi for such activities should itself be the subject of research.

II - Clinical processes

The clinical process followed in medicine should be followed in relation to building design, not only for analysis of structural failures but in terms of the social and occupational functioning of the building.

Design innovations arrived at intuitively by progressive architects should be the subject of such clinical analyses. Such clinical findings are useful in defining research.

A converse type of analysis would lead to the determination of the effect of building layout and spaces on the occupancy activities.

This clinical approach should be extended in time over the useful life of the building.

III-Team Effort

While architectural practice is increasingly performed by teams, the analysis and presumed benefits of interdiscipline activity in research suggest that team effort should be stimulated in professional education and in the standards of professional practice. It is recognized that the fee system of remuneration militates against a desirable amount of research in advance of design by architectural teams. This condition will change only gradually as clients become more appreciative of such research. In the meantime, a function of a central research organization would be to select and clarify problems which could be researched and reported for the benefit of a great number of practitioners and their clients. In this manner the valuable contribution from a range of disciplines may be made available to the individual architect who could not assemble such an array of specialists on his individual projects.

IV-Gaps in Responsibility

The programming and allocation of research should be especially concerned with areas which are not normally taken as the responsibility of any one scientific or professional group, partly because they involve several disciplines: As for example, crippled and disabled people, accident prevention, environmental factors in juvenile delinquency, etc.

V-The Spectrum of Types of Research

In order to stimulate the architectural profession and to popularize research there should be examples of immediately applicable subject matter such as traffic flow of crowds, a basic investigation of stairs, etc., such as are common to a variety of building types. At the other end of the spectrum are types of research which are composite but of longer range and of less immediate application.

Other obvious subjects are a variety of specific building types.

Between the specialized across-building types of research and "field research," or analysis of completed buildings, there should be careful formulation and support of composite research on units of major building types in which a number of variables are kept under control while one of the factors is varied. It is recognized that this type of research is fraught with difficulties of maintaining controls. It may appear to be costly but would not be, compared to the millions of dollars spent in typical trial and error application of innovations to thousands of repetitive building units.

Another type of inter-discipline research would be an analysis of fads and fashions which sweep across major building types, apparently based upon publicity and copyism without rational analysis, or the ardent propagation of innovations by specialized consultants on building types.

VI-Composite Research vs. Pure Science Research

Research in the classic pure sciences is generally well understood and supported. The most difficult problems are in the interaction of factors represented separately by the individual sciences, the character of which is changed by the interaction. The definition and the control of such research is unusually difficult and

requires specially careful analysis and statement. In addition to the confrontation of the sciences in a number of building types, there are problems of a much larger scale involving human ecology, geography, population trends, natural resources, and the problem of discovering predictable trends.

In this connection the concept of scale and scope of design must be greatly enlarged to include areas now designated regional and urban design. This enlarged scale should include a time element with effort to anticipate future requirements to accelerate progress and avoid repetition of outmoded concepts especially in areas of delayed economic and social development.

Related to industrial society is the necessity of more intensive study of interchangeable, prefabricated elements which will bring the benefits of industrialization and mass production together with the possibility of flexibility in design for varied requirements. This would tend to resolve the dichotomy between the costly completely-custom-designed structure and the sterility and inadequacy of prefabricated large building units.

VII-Obsolescence

An age-old problem in the building industry is accentuated by current rapid acceleration of technologies and of occupancy requirements. A great deal of research is indicated both in the analysis of occupancy trends and in planning and structural devices for greater adaptability of buildings. Such studies include the investigation of the varying rates of obsolescence of essential building elements relative to the economic life of the building and its social usefulness. One function of a central research organization would be the constant appraisal of the rates of change in occupancy practices and the optimum balance of physical obsolescence of building components.

VIII-The Building Industry as Field-Laboratory

While architects do not generally think of their activities as research, actually each building project is a research project. It has been declared that the world's greatest building research laboratory is the offices of American architects. There are numerous instances of particular research in advance of design, but multitudes of decisions in the design of a building are based on an accumulated experience which in the large constitutes "the practice theory." A major operation is the adequate reporting of specialized research and general innovations: many of which could be classified, reviewed by types, analyzed and published. This would not constitute the full scope of research since there must also be experimentation without assurance of satisfactory results. However, even in this "field research" there could be limited application of new ideas and new materials which, if proved to be unsatisfactory, could be replaced at small cost.

This "field research" need not be limited to structure and material. There is great need for carefully designed and controlled investigations of occupant's use of completed buildings of all types.

IX-Recruitment and Development of Research Personnel

Research cannot be too rigidly programmed or controlled. Success in research depends to a great extent on individual

personal enthusiasm. The problem seems to be to incite the interest of capable people in fields somewhat related to the problem at hand. If the researcher can see in this problem a possible contribution to his field of personal and professional interest, this is more effective than an appeal to his charitable concerns or his pocketbook. This general principle is incompatible with the concept of a gigantic research center. In general, research should be decentralized according to human resources and available facilities. A research center would serve only for coordination, documentation and the avoidance of duplication.

In addition to periodic interdisciplinary conferences, a continuum should be provided by joint appointments between university departments. The appointees should not be totally separated from their peers in the same discipline.

There should be definite provision in the architectural profession for a specific category of research worker with adequate prestige, tenure and security.

The lack of experience and habits of engaging in and reporting research could be corrected by the introduction of more research-minded professionals in the faculties of the schools of architecture, and not only for the purpose of training researchers but to develop in future practitioners a receptive attitude toward research and research findings.

This goes farther back into the criteria for the selection of student architects and the provision for recognizing motivations toward research and methodical practices to supplement those whose motivations have been art and design. Deans of schools of architecture should be urged to insist upon research contributions and the development of research abilities of their faculty members. School budgets should be adjusted to permit sabbatical leaves or reduced teaching loads to encourage research activity.

X-Documentation and Communication

This pertains to the collection, classification and dissemination of past and present research findings but the problems in these processes are also subjects of needed research. Documentation is the big No. 1 problem requiring additional concerted efforts. This is not unique to the field of architecture and building and much can be learned from other disciplines. A basic difficulty is that architects as a group are not trained or experienced in reporting and publishing as are men in most of the scientific disciplines. This is a problem in the education of architects generally and in the training of researchers capable of evaluation of research findings. Reporting of research is almost non-existent in architectural journals. There should be developed a demand for this type of publication, perhaps with incentives in the form of prizes for the best technical papers.

There should be research and education in the professional schools in the techniques of interviewing and the listing of data essential for design.

XI-Terminology

The propriety of the term "architectural research" is questioned. While by custom and practice the architect is the coordinator of many technologies in the building design, it does not follow that his position in research is analogous. Optimum research programming results from the interaction of many disciplines in the

In the AIA Special Report No. 4 it is stated that architectural research is a subdivision of building research. In view of the much broader scope of research envisaged by this conference, the reverse would be more nearly correct. No one professional can adequately formulate the problems alone. clarification of goals and research problems. lems. In many such collaborative efforts a leader may emerge from any one of the disciplines involved, according to the nature of the general problem and personality and ability. A recommended title for this total activity: "environmental design research."

THIRD DAY ASSEMBLY • UNDERLINES AND GUIDELINES

Herbert H Swinburne, AIA, Chairman

(Swinburne) I am about to congratulate you, Burnham, after the presentation of all these reports. You are the only pure group here because in spite of the protest to remain original and not eat the apple of specifics, I think almost every one of our discussion groups succumbed to temptation and finally wound up in specifics, and yours is the only one that didn't.

(Kelly) Well, I'm not an architect, although I am a member of AIA, but I really deplore from the bottom of my heart this tendency to question whether there's such a thing as architectural research. Now, I grant you, that we may define it in a particular way but unless we're willing to backtrack and say that there's no such thing as a profession of architecture, that it should be called the profession of environmental design--I see no reason why we should say there's no such thing as architectural research. Let's take a look at medical research-- it's done by biologists, by chemists, by psychologists, by all kinds of people. Look at legal research-- it's also done by all kinds of people; but nobody in the legal profession will let you say there's no such thing as legal research, and nobody in the medical profession will let you say there's no such thing as medical research. I think it is tremendously self-defeating to say that simply because it is advocated by and because it involves other disciplines, it should not be called architectural research. In any profession the standard of service must be higher than the needs of the immediate client. I think we owe it to ourselves to admit that we are studying the basis on which the profession stands whether it be an intellectual basis, a design basis, or whatever basis and that this is a field for research. Now, I would like very much to see if I can get a fight on this.

(Campbell) I would like to go on record backing Burnham's statement - with a minor exception. I would be very happy to be the chairman of a committee on research in architecture but I do want to insist upon the thought that because it is architecture, regardless of how many disciplines, it's a focal center. "Environment" can mean everything! - it certainly means architecture but I think it's so broad that it loses force.

(Dietz) Certainly there is a field which is architectural research. I think it is very important to recognize that if there is a profession of architecture, then there is certainly also a field of architectural research. I believe the term, however, needs rather careful looking at. Let's look at other fields where research is a

recognized activity. Let's take civil engineering for example. There isn't any such thing as civil engineering research per se. There is research in soil mechanics, research in structures, research in many phases of civil engineering, all of which together constitute civil engineering research. The same thing is true in physics, or in any of the disciplines that we usually think of as being specific areas, professions, sciences, or call them what you will; there is no research in physics as such. There has to be research in the many phases of the area that we consider to be physics and the same thing holds true in architecture. We will carry on research in the many phases of this area which we consider to be architectural activities, and they together will constitute the body of architectural research.

(Richardson) I've been worrying a little bit about Mr Kelly's statement. In any kind of statement one has to improve on his writing and I think there may be two kinds of audiences that we have to consider here. First of all, I think we have to consider the architectural specialists and their fine purpose here and recognize that the profession is now in a position where it is becoming interested in research, which I think is extremely appropriate and relevant. Contributions of other sciences could form a series of steps as one goes along to develop the reasons one does research. I think you might say, for instance, certain things are recognized and we have a lot of available knowledge which we are not putting to use. This means that we search around, we find information, we assemble it and we bring it to the group that can utilize it.

I think there is now a second step in which we search around and we do not find the information we need to solve a specific problem and so we undertake an investigation which can or cannot have basic research implications. I don't want to get into discussion of this "applied-basic" research with you. You start with motivations, seeking answers to a specific problem.

The next step is the recognition that there is a basic body of knowledge, which is our sort of working capital, which is utilized whenever we go to seek the answer to the specific problem. One more thing--each group of people looking for a specific answer has to contribute towards this pool of basic research which can be drawn upon, and this is certainly apparent, for example, in private health organizations. We must recognize that this kind of study will be general, will have application for always. In all of these steps, the underlying motive is to get the answer to specific problems to build bigger and better things.

It seems to me there is a final step and that is that the advancement of a frontier of knowledge in and of itself should be highly valuable in our society. This is a step which I think very few people take, or are willing to take, and yet I think it's almost a basic need in our society.

Now I think this comes back to my original question - what is the audience to whom we are speaking? It seems to me that if we're trying to speak for, but to avoid, an audience solely of scientists, or the people of the professions; if we could indicate this hierarchy to some extent and subscribe to the general policy for the advancement of knowledge for the public's sake in addition to the practical implications, and then come down the various steps, it would be a statement of wider application. Maybe I'm trying to do too much in one statement.

I think this is an exceedingly good thing - and it would take much more time than

we have to make as good a statement as this. I tried to reflect the general feeling by changing the phrase you disliked to "standards of human environment" which I think at least begins to reflect what you are now suggesting that the aim is not to increase the special service of the architect.

I like the suggestion that came from Mr Horowitz's group "research for architecture".

(Horowitz) I would like to have Prof Ittelson talk on this point because he was the one social scientist that we had working with us and I think that we depended very much on his views in making that subtle statement. I think it started with the words "environmental design research" and then shifted into "architectural research" and then "research for architecture". Is that correct? (Answer: "Yes").

(Hastorf) Research begins when you have a phenomenon--you don't sit down and say I am going to do research. You have got to have a phenomenon. To a certain extent this was the decision our group made. We dealt in specifics primarily because you must start somewhere. Now, on this information-gathering issue that seems to have arisen, I consider the accumulation of information is not necessarily the only kind of research that ought to be done, but I think it's a beginning place and I think that by doing it you have then got to decide what sort of information we are going to try to get and you have to generate some ordering of this. That means you have got to start specifying the variables of concern. It is important that we do not set such global goals that we are immediately doomed to failure--so global that you can't specify them if you don't have a phenomenon. Very clearly I am in agreement with Foley that you have to start thinking about some theoretical organization of what you are doing. But you have to start at the bottom, too. You have to get your hands dirty quite literally in trying to study a phenomenon.

I think there has been a little setting up of straw men here and there, particularly when mention is made of an enormous research organization which would presumably be dictatorial--tell people you will do this and do that. I don't think that was ever suggested. On the other hand, I do believe that a group, profession, a committee or what have you, can discuss things and come up with conclusions and so forth, but nothing will happen until some one guy says, "Well, let's go".

Maybe he goes wrong in the first place, maybe he has to come back several times and start again but you do have to have some central action. That action certainly should be--I don't like the word guided--but it should have the advantage of advice from those who are deeply concerned with sources of information and the outcome. We have plenty of advice (some that you can do without) but you really have to take it all in in order to get that which will turn out to be useful.

I am surprised, like other people, with the very great degree of unanimity that has come out of this conference and I agree with the chairman in doubting whether a group like this could ever come up with a formalized scheme, a single recommendation for procedure. In any case that is not our job. It would be invidious for us to do it--this must be done by the people who brought this meeting about in the first place. It would not be at all a difficult job for someone to sit down now, take the reports they already have and come up with an integrated proposition which would

cover 90% of what has been said.

Some of the discussions we have had have been partially semantic. They are discussions which will go on in the future, some of them are discussions which will never terminate. This is good, this shows that the organization is alive; when the discussions stop then we had better write it off.

(Kelly) I have tried to rephrase this Statement which I hope will be able to represent a consensus of the group. It seems to me useful to the AIA Research Committee and to the profession to have some statement of consensus if we can.

The suggestion was that in the middle area where we talked about research in other fields, the implication seemed to be that we were interested only in the interpretation and translation function, bringing things in from elsewhere and putting them out to elsewhere. If I may read it all again I will: "There was a high degree of unanimity among those present at the Conference, including men from other disciplines, men already engaged in architectural research and practicing architects, that there is a basic area of architectural research that deserves major attention at the present time. This area was described both as an area of clinical research and as a middle ground between the more specialized disciplines and the practicing architect. Research in architecture, as in comparable fields of professional service such as law and medicine, should be devoted both to the advancement of knowledge and to enrichment of service to the public. Progress may be made in stages through ordering of existing knowledge to pursuing solutions to questions now unanswerable and finally to making additions to the store of fundamental knowledge as well as withdrawals from it.

"Most of the research work now in progress in architecture is of applied and developmental nature since financial support tends to be concentrated on projects which explore detailed construction problems for industry or government. And since projects more basic to architecture tend to be more complex and are less subject to investigation by conventional methods, it is important for the profession to declare its concern for the more basic area of architectural research, to speed the development of appropriate research techniques, and to open the way for specially qualified research men to find a career of respected service within the profession".

(Zucker) There are quite a lot of topics which could be the subject or object of architectural research or research for architecture, however we call it. After all, in spite of all readily admitted influences, architecture is an art and therefore an object of esthetic analysis. In the lists we received about research topics and also in the various reports of the groups, there are no real, genuinely intrinsic problems of architectural esthetics mentioned. Only indirectly. But there is nothing basic like, for instance, the relationship between architecture and color. The particular subjects of which I am thinking sound general but can be worked on in a very specific way. A very important question which may have some practical application is not mentioned--it is the change, not only in the concept of space and what are the reasons for it, but even in the perception of space. The relation between visual and kinesthetic perception of space. I could give you many, many examples. In addition to problems and topics you have mentioned, architectural esthetic research, pure esthetics, sooner or later applicable but

not immediately applicable, should also be a research field in our concern.

(Taylor) I am very glad that Dr Zucker had an occasion to speak. The reason that Dr Zucker was invited is because I try to read the Journal of Aesthetics and I must confess that generally speaking the only parts of it that I have been able to really understand are Dr Zucker's contributions. I certainly want to underscore what he said. The area of esthetics is supposed to be one of our prime contributions and many of you have heard me say before that we all are doing it by hunch and by guess and by rule of thumb and it is high time that we tried to introduce some rationale into it.

I must anticipate the objections of most architects. They say, oh well, you can never reduce creativity to a formula. Granted, but every science, every field of knowledge, has to assemble its data in an orderly fashion and then it has to make the "intuitive leap". (That's an hypothesis in science). So what we are talking about is a better ordering and a better approach to our creative design without trying necessarily to reduce the creative act to a formula.

(Bannister) The report by Mr Horowitz' group had an interesting reference to the lessons that history might contribute to our knowledge of present-day practice and knowledge. I was a little worried about that because historians, too, are in the stage of beginning research. It has been going on for centuries but our knowledge today and, for another generation, will be in the collection of facts and trying to establish just what happened. Nevertheless, I think we may be able to direct a competent scholar to abstract from this historical record some of the things that Bob McLaughlin was talking about.

There are many problems of esthetics which will be illustrated. There will be many problems of construction--why did a certain historic dome fall down? When we find that it was due to plastic flow it gives a little up-to-date flavor to it. We can also find in the accommodation of the functions to be housed in buildings a long series of experiments which I think will be pertinent to some of our problems. Nevertheless, there is one other factor. Certain recent studies have shown that buildings not only are tangible and physical solutions but they are also ideological solutions. There has developed in recent years what we might call an iconography of architectural form. The studies of Baldwin-Smith at Princeton have illustrated this in considerable detail although they are still somewhat speculative.

I think that all of these problems will illustrate for us today some of the basic problems of architectural knowledge and this is one reason why I am so concerned that architects today tackle this problem of formulating a workable theory, a tested theory, such as has been mentioned. Again I think one of the most hopeful things on the horizon has been this Conference from which I trust we can take back the many ideas bandied about and begin to work on our architectural faculties, although we, too, are human beings and it will take some time and some encouragement from the profession to change our attitudes.

(Beyer) I am not sure that some of the unanimity isn't built into this discussion by your selection of the people here, I know that sometimes when I discuss these problems with my own people there

is much more disagreement than we have had around the table here. So I think the Steering Committee, perhaps, should be given credit for some of the results that we are seeing.

I wanted to mention just a word on this built-in characteristic of the team approach. I think we are talking about the team approach--we aren't talking about what I mentioned at the end of my paper yesterday: one person knowing all things and therefore not being a specialist in anything. In this team approach the storm warning is expressed very nicely in a paper that I have had on my desk for some time and finally read, called "Research for What?", by Lawrence Frank. Most of the paper is on this subject. He says on page 17, and it is very appropriate to our discussion, "Assuming then that we should approach social research (he's a psychologist) for application in terms of organized complexities for which we can design various models--What methodologies can we use? The mixed team offers one possibility. But, as you all know, this has certain difficulties arising largely from the fierce loyalties of each member of the team to his own discipline and to its assumptions and its methods. Also, each member of the mixed team is usually concerned only with the problems which his discipline says are important and he considers the others insignificant."

Now, I have mentioned this not to defeat the purpose of this Conference, but only as a storm warning because we have discovered when we have brought together on our own campus the sociologists and the architects and the psychologists there is a period of adjustment, a period during which you have to develop communication. There is a period in which you have to get to understand each other and I am expressing this now because I think we have learned that it is only through the total effort of these groups that we can really get the kind of comprehensive grasp that we are talking about here today.

(Campbell) There seems to be disagreement in relation to the team approach and who is on the team. I am thinking now of a team in the planning sense for research, not a team doing a particular project. I know that in our own group discussion, Byron read a rather strong recommendation that representatives of other sciences be actually brought into the AIA Committee on Research; Mr Horowitz seemed to disagree with the principle that other disciplines should be brought in and have continuing direct representation. Have I misunderstood that or is that a clearly defined disagreement between the two groups?

(Horowitz) The feeling of the group on this was not that such organizations weren't desirable but that it was unwise to attempt to define the character of that organization independent of knowledge of the particular individuals that you were bringing together and the problem itself.

(Campbell) I did misunderstand then.

(Richardson) One point I would like to make comes from three different sources--first this discussion of interdisciplinary research, the others from two references in different reports. In the work I am doing with my Association we have been concerned with accident prevention. I have gone through considerable soul-searching as to what has been accomplished in terms of general progress in the field of accident prevention research, and when I underline research I think there has been very little done. What we have done is to stimulate

in eight different areas--six in this country and two abroad--interdisciplinary faculty study groups somewhat along the lines that have been discussed in different reports and these are at some of the major universities. There is one at Washington, UCLA, Stanford, Minnesota, Harvard, New York and at the World Health Organization and so on.

These groups have been going about two or three months. They are bringing people in from many different disciplines and we do not have much representation from architecture. I think that this has been a mistake and maybe this is one specific place where there is already a group of people who are dealing with a problem which often is not dealt with because no one group has clearly delineated responsibility for it. I think that this is likely to occur. You have to have these kinds of groups in problems where no one particular group has squarely assigned to it an over-all responsibility. In the seminars so far storm warnings have been sounded and I would heartily second them.

There is initially an extremely discouraging floundering around that one goes through, I think if people are not fully aware that they are going to have to put in a fairly major investment of time and frustration before they can start working together as a group, a lot of people may go into this rather starry-eyed and may get scarred and cynical before they get through this horrid slopping around stage which I think is inevitable. Hence, I heartily second what our friend Beyer said about the need for a warning. But this is not discouragement. I think it is an essential in dealing with some of these problems in which so many different disciplines have to be considered.

(Hauf) I hate to get into semantics again but I have to quarrel with this pessimistic classification set up for me. I certainly do not consider in the least pessimistic my own statement that I believe we can make faster progress by developing existing research resources than by setting up what is essentially a research bureaucracy. In fact, this, in my view, is an optimistic statement.

In the Bloomfield report--I expect these are going to be known by these names forever--Byron pointed out we should encourage architectural schools to do research and Walter Taylor's report also argued that architectural schools' budgets should be adjusted so as to provide for sabbaticals and to provide funds or time for doing research. I don't think you will find any objection by administrators of architectural schools to these statements but I would hate to let them stay on the record without saying they won't get anywhere unless somebody finds a way to finance it. Even the public institutions are having trouble meeting their payrolls, but in private education today, although it would be fine to expand the budget to provide for research, the funds have to come from somewhere.

One other thing. In the Taylor report--and this is really tied up to my abhorrence of research bureaucracy--he stated that this activity should be carried out on university campuses. I would hope that the committee would be willing to make that read "college and university campuses."

(Taylor) I am prompted in this by a little urging from Walter Campbell and Eric Pawley, also by Harold Horowitz' paper which perhaps was unduly modest, and Harold Hauf's saying that we should build on the beginnings we have made. It may be that non-

architects here would think that we are absolute babes in the woods. What we have done since the establishment of the AIA Department of Education and Research has been ploughing the ground and seeding the minds of the profession, we hope, so that we believe we are building up a climate favorable to research.

For several years in the AIA Bulletin we published a clinic service reporting form and because architects are not accustomed or bashful about exposing mistakes, we got very few responses. Where appropriate we did follow through with an investigation--checked with manufacturers and engineers, and so on, and reported findings in the press without naming names, and made confidential reports to the architects and builders and manufacturers in question.

I think you may know that we are establishing a Building Products Register which is not research in the pure sense but is a guide to products, particularly in terms of the properties of materials. Related to that is another project not yet quite off the ground, the Index of Architectural Information, which is a bibliographical guide to background material. We also propose a specification service which will assist the architect in specifying more accurately what he intends to use.

We have a number of Building Type committees. The Committee on School Buildings and Educational Facilities continuously reports its findings--special studies on certain aspects of school building design. The Committee on Hospitals and Health has made careful investigations of space distribution and cost analyses of hospital buildings. We also publish Building Type Reference Guides, about eight so far, which again are pretty pragmatic but they do bring to the architect the best information in a condensed form and a guide to other sources in a number of major building types. And the School Plant Studies--this series has gone on for 30 issues which are very much in demand and widely distributed as reprints.

We also publish Technical Reference Guides that cut across the building types, such as Corrosion or Color. We also publish technical bibliographies and architectural abstracts -- items that we believe useful to practitioners.

We have had exploratory conferences on certain specific problems. Our Hospital Committee began some years ago with the American Hospital Association, to try to set up criteria for research in hospital planning. After a long delay we were granted $300,000 by the US Public Health Service. We have selected a leader for this research project to be jointly administered by the American Hospital Association and the AIA.

We also were successful in bringing together the appropriate division of the Department of Health, Education and Welfare, the Council of Rehabilitation Centers and some experienced people at Pennsylvania State University. They have made a government-supported 18-months' study of the criteria for planning rehabilitation centers and that work is about to be published.

We have worked closely with the American Psychiatric Association in their research and in their clinic conferences for the design of mental hospitals.

Referring to the kind of things Bannister was talking about, I was able to help one of our members to get a grant in which

he made a study of radiant heating in the Roman baths. This has been published in the AIA Journal and in the Heating, Ventilating & Air Conditioning Journal and some other places.

We have also a $25,000 project with the Educational Testing Service (jointly with the Association of Collegiate Schools) for some aptitude tests for assistance in the admission of architectural students. These involve some entirely new types of tests along with some items from other batteries of tests. We are waiting for several hundred pilot students to reach graduation so we can evaluate their original tests.

The architect in his responsibility for creating structures is usually the first person that the client, whether he is an individual or a body, deals with after initial decision to build. Also he is almost the last one in the field still responsible for the completion of the building. Unfortunately, the architect has usually ended his obligations at that point. We need to carry on our responsibility and know and evaluate how effectively we have done this.

The other consultants, the builder, the kitchen expert, all are very necessary, but it is the architect who interprets them to the client and eventually puts together their contributions. The responsibility is very great and we can't remain as aloof as we have been.

(Swinburne) One of the most important things mentioned here was in Dr Foley's paper where he has shown an S-curve diagram connecting social organizations aspatially and spatially. Architects have been concerned too much with exclusive consideration of spatial organizations. As a sociologist Foley is saying: Let's stop your conceit here at this point, there is also an aspatial organization and we can help with it. I think this S-curve is just as important as the 1-2-3 triangle relating to the individual.

(Foley) Without going into detail on this S-curve, we found this emerged in the course of a project in city planning rather than in architecture but by analogy we felt it applied. Our problem emerged in terms of city planners' responsibility for recommending certain spatial organization and ultimately a certain physical environment. Our problem was to try to make some connections, even though relatively modest, with a series of fields that also in one way or another dealt with a city. The thing that we became increasingly impressed with was the fact that many of the social sciences are essentially aspatial in their orientations. We became intrigued with the bridge-building problem here. Not only social scientists but many business people think in terms of their organizations essentially in functional terms --delegation of responsibility, organization charts, etc., and there is an important problem of devising ways by which you may move conceptually from the aspatial to the spatial.

One other point, since there has been some suggestion at the conference that competent research will come only from trained researchers outside of the architecture field, I want to speak up strongly against this view point. It follows from the fact that architecture is a distinctive field, that architecture as a profession and architects as professionals are faced with distinctive kinds of problems. Hence, architects are going to be far more competent than outsiders at many points in identifying these

problems and attacking them. But this must be a genuine and systematic search for tested architectural knowledge, not a patch work of ad hoc studies.

We happened to use this little diagram in a good deal of teaching, particularly with city planning students and we try to tell these fellows: now look, you are going to have many, many situations where people are thinking aspatially. Maybe one of your main professional challenges is precisely the challenge of trying to translate. Maybe your expertese is in this translation into spatial terms and maybe you've got to take as given many things that are aspatial.

(Kelly) I think Dr Foley cast one of the real pearls of the conference that is of profound significance. I am not sure that I understood all of what he said but I do want to speak of it.

It concerns the importance of the content of the profession in the form of theory and principle, which I believe is something of an emaciated body at the present time. Fortunately or unfortunately, the theory and principles of the profession that we know about and can express are so often built on the historical accomplishments of the architect -- architecture is an old profession. Such expressions as commodity, firmness and delight, while quite picturesque, I think are not quite enough to cover the proliferating activities which go on within the profession that as yet are not backed up by a clear statement of theory, principles and objectives. As I see it one of the significant things that such a body of research as we are talking about here can add to the profession is just in this body, or content of the profession.

I had an interesting experience many, many years ago when I was at MIT. I was asked to look over some old drawings along with Lawrence Anderson and Herbert Beckwith, to discard the old, unneeded drawings that had been made by students. We ran across an automobile plant which had been designed by a student in 1911 and it was a perfect plan of a Gothic cathedral. In the chapels were forges and metal crimping machines and other places where they manufactured Prest-O-Lite headlights, I guess. There was an example of a function being rationalized from a form. There are so many examples of poor practice and poor comprehension of the content of the profession as we see it in architecture today that could be made more sensible, could be rationalized, which would then give us a filled-out content in the profession that we don't have now.

Dean Wurster of the University of California, as many of you know, is at the present time giving serious consideration to a change in the name of the School of Architecture to the College of Environmental Design and combining in it the School of Architecture, the School of City and Regional Planning and the School of Landscape Architecture--over, I might say, the angry protests of the profession. I suspect that one of the real reasons that leads to such a move is the fact that the content of the profession as we see it now does not really cover the enlarged field of practice and influence that he sees for the school and hopes to include in a different name.

(Taylor) I wanted to comment and support Dr Foley's statement. I would like to go backwards on this S-curve and I believe that he would accept this. The converse is the effect of the spaces on the

organization. The popular quote is, of course, the famous one of Winston Churchill's that we shape our buildings and our buildings shape us.

Bannister will remember that at the Chicago Conference prior to the (Mid-Century) Survey of the Profession, we had the Personnel Manager of Marshall Field meet with us. He talked a great deal about the effect of office space organization and mercantile space organization on the personnel and how oftentimes people were forced into an undesirable organizational pattern. I think it calls not only for adaptability of our buildings but also for study, including the sociologists and the social psychologists and whoever else, to study the effects of building space and environment on the social structure.

(Swinburne) Seated across the table from me are two gentlemen who are responsible for this meeting. One is Byron Bloomfield and the other Dr Nordby, ex-National Science Foundation. Dr Nordby is a member of the Steering Committee which formed this conference, but more than that he was our liaison with the National Science Foundation.

(Nordby) Some of you don't know how this Conference got started. At one time I taught a lot of architects the structural courses in civil engineering and when I moved to Washington one of the functions of the National Science Foundation was to bring together conferences of this sort. So I talked to my good friend Byron Bloomfield, who had moved to Washington also, to join the staff of the AIA, and talked over a conference of this sort with him. I had had certain problems with architects in teaching and because of this we decided that we would promote a conference to see if some of them could be solved. I soon found that I could get the architects whipped up into a fury faster than I could get the National Science Foundation. I had overstepped my bounds.

After considerable work and browbeating of my colleagues I did manage to get the funds approved. But therein I got an insight into the opposition of the "pure sciences" to architectural research in that it seems they have a certain amount of conceit about doing research and they feel the architect is infringing upon them. I am not sure whether it is altogether conceit on their part but it has a certain protective aspect in that they have the money and we do not and there isn't enough at present for both. They don't want to dissipate their funds. I am glad that the funding situation has not come up any more than it has in this meeting because it is a major problem we are certainly going to have to beat in this game of getting architectural research done. I found in administering a program there that it wasn't so much getting the money that was important as it was finding ideas. If you had good ideas and could propose research for an excellent purpose the money would come. I think that is one of the major things that professional architecture is going to have to do, it is going to have to bring its purpose before the public much as medical research has done. They are going to have to show the public the importance of doing it.

Unfortunately, many times the research that we would do is not an exotic type of research, such as let's say sanitary engineering. Sanitary engineering is something we have to do, it deals with human wastes, but the public certainly doesn't get excited about it as they do with cancer or heart disease. Maybe we will touch more on that when Dr Kobayashi speaks

on the nature of basic research.

I am glad we didn't get into the morass of trying to define basic research in architecture, because too often research is distorted. Burnham Kelly made the point that there was money available already for planning and we could be led down the primrose path in trying to distort architectural research down the planning road in order to get the money. There is an equal danger of dragging architectural research down the completely basic road because there happens to be money for basic research, or because it is the fad of the day. I have evolved a definition of basic research over the years because of this. Basic research is what I am doing -- what you are doing is applied! Because it is good to do basic research these days you don't do the applied kind. I think that we have to concentrate on what's good for architecture, what's good for the fields that associate with architecture and not dwell on this word basic.

In the field of architecture, there has to be some recognition of the person who does this job of research. This is something that our committee discussed at length and didn't come out with it in the reports this morning. There is one thing that's universal and that is creativity. Architects create in one manner, scientists create in another and it takes a creative mind to come up with things in any field. I am not sure that in the field of architecture we recognize research creativity or develop it. I always hated, when I traveled for the National Science Foundation, to give too much encouragement to architectural schools because I would always come back and get a flood of proposals from people who were over-encouraged and wanted to 'do research'. Then I had the distasteful job of turning them down. Because research is a good thing to do these days it is one of society's expectations of professions.

Architecture should develop a certain breed of cat that concentrates in research because research is a business, or let us say a profession, which intersects all other fields. There are certain traits which make a good researcher. Many of us are proud of our profession as I am, of being a civil engineer but sometimes I wonder whether I am a civil engineer. Sometimes I prefer to be called a scientist because I am not sure that civil engineers always accept the researcher -- the basic researcher -- and I think there are people who are trying to be researchers in architecture but I am not sure they areaccepted by the profession as a whole.

(Campbell) I note that Dr Kobayashi, representative of the National Science Foundation and identified with the Division of Mathematical, Physical and Engineering Sciences, is with us today, although he was unable to get here for the earlier discussions and papers. We are happy to welcome him and hear from him on 'The Aims of Basic Research'.

(Kobayashi) Your comments this morning have given me a new appreciation of the problems involved. I think what is happening here reflects the tremendous changes and advances which are occurring in all of science and technology. It reminds me somewhat of what happened to the engineering profession during World War II and thereafter. During this period the engineer found that the empirical or pseudo-scientific training that he had before was inadequate to cope with the highly scientific and complex problems of that period. Now the architectural profession is beginning to realize that they are going to have to do more research if they are going to stay in the particular area which is their prerogative.

In another sense what is happening here today parallels what is happening in some phases of engineering. Many modern engineering problems present themselves as complex system which require the integrated resources of many areas, such as mechanical, electrical, acoustical and a host of other disciplines. It is no longer possible to deal with these complex systems part by part, you have to deal with the system as a unitary whole because of the wide range of rapidly changing situations which exist.

The need for personnel that can cope with these overall problems and can grasp the entire picture and can synthesize the various elements involved, this demand is definitely established and this demand promises to grow.

In the same way architecture must combine the physical, biological and other factors that are similar, in the engineering field, to what we know as systems engineering or operations research. To cope with the overall problems the systems engineer and the operations researcher are making use of relatively new and exotic areas such as linear and dynamic programming, information theory, plane theory and a host of other relatively new areas.

The architectural profession might take a clue from this and develop its own tools or borrow these already existing tools wherever they are applicable. This does not mean that specialists or experts in any one area or field are obsolete. Quite the contrary, experts in any area are a vital part of this picture of the whole operation and it is they who advance the frontiers of the particular discipline and pave the way for future progress in technology.

This brings us then to the topic, 'Basic Research and the Aim for Basic Research', which is supposed to be the title of this talk. I always hesitate to say anything about basic research because you get into such an argument with various people who are involved but I think there are certain characteristics of basic research which are common wherever you may take this basic research to be, close to the scientific end or close to the applied end. One of the characteristics is that there must be an element of surprise, of accidental discovery, accidental because pure basic research cannot be planned except in the mind of the investigator as an intuitive idea

Also there is an element of time involved. In truly basic research there is no pressure or should be no pressure of time, while in practical applied research there is always this element of time, you are always pushed for an answer.

Finally, in basic research there is this element of being very general. Basic research does not answer one specific problem. It applies to many, many areas and paves the way for future investigation.

I note that in this Conference on Architectural Research you haven't specified too closely whether it is to be basic or applied research, but in the summary sheet of the foundation grant I note that two of the items to be determined are, first, definition of needed basic research and, second, exploration of sources of financial support. In this concluding panel discussion I would suggest as a representative of the Foundation that in formulating guide lines for future investigations the difference between basic and applied research be kept in mind. And also that in looking to the National Science Foundation for future financial support you must realize that the Foundation is committed by legislation to support basic

rather than applied research.

This I know we can get into an argument about because in basic and applied research you cannot draw a definite line between them. It is something like a color spectrum where one color blends right into another. There is feed-back between basic research and applied research, the basic research extends the horizon of applied research and applied research initiates, assists and motivates new areas of basic research with new ideas and techniques.

(Campbell) Thank you very much. From hearing what you have said I think we are even more sorry you could not have been with us during the discussion. I am glad you pointed up the problem of basic research and certain responsibilities on our part but I would also like to say that I am happy we did not devote great time, detailed time, to trying to distinguish between basic and applied research during this Conference and I might add that while we seem to have ignored it I think that was done with the advice and permission of National Science Foundation people.

I think most of us here, as architects in representing the Institute and its affairs, take this very seriously, very personally, and I think that we can assure you that we are intensely interested and have no intention of letting this die in any sense with this one meeting. I think this is just the beginning.

(Nordby) In engineering, in recent years we have developed a group of subjects which we call the engineering sciences. The Engineers Joint Council has even formed an Engineering Sciences Committee, of which I am a member, to advise the government on their support of research in these subjects. The trend toward the engineering sciences grew out of physics, I suppose, in that there was a certain group of subjects which was being mistreated by physicists these days. This includes subjects like fluid mechanics, solid mechanics, etc. These are fields which are almost deserted by the physicists today because of their interest in more advanced subjects such as atomic physics, cosmic rays, etc. I wonder if we haven't missed an opportunity here. Architecture isn't all art--there must be some science to it. I was struck by Dr Zucker's statements this morning on esthetics. I think what I inferred there was that there might be some science to this and I think that maybe this is true. Maybe mathematics can be applied to this.

Ehrenkrantz was telling me yesterday, for instance, that there is a mathematical problem of partitions which has not been solved yet. The theory of partitions, not in the sense of wall partitions, I realize, but this did apply in this case to housing and building. I wonder if there isn't a group of neglected sciences here which architects are concerned with and which we should refer to as architectural sciences.

(Campbell) The expression "the science of architecture" is not unknown and one hears it frequently used without, I think, having any exact idea of what we mean when we use the term.

Now we reach the Underlines and Guidelines which are going to throw a burden on the men involved who by and large are the authors of the original papers. Allen Pond will be first to speak.

(Pond) The experience of the last 48 hours underlines in my own mind the problems that I saw when I was drafting my original paper but couldn't pin down clearly enough in my own mind as to what the form would be, or the content, or the general direction for a program of research in what I would like to think of now as Architectural Science.
All sections reporting this morning, with possibly one exception, emphasized the inherent needs of any broad professional group if they are intent on launching themselves into a research program. Although I am neither a scientist nor an investigator, I happen to be in a spot where I can have some access to quite a lot of scientific talent. I can offer and do offer whatever services we have in the Department of Health, Education and Welfare that can be helpful to AIA in the months ahead.

We in the Public Health Service operate a full-fledged, broad-scale, heavily-supported research activity at the National Institutes of Health. We are also just beginning to take a serious look at the needs of research in education and we are making our own first efforts to come to grips with some of the problems and to develop approaches that will be useful in focusing attention on a subject which is certainly of wide concern and yet well understood.

We have gone through a little greater detail and have considerably more experience now in the establishment of a research program in vocational rehabilitation. We are still toying with the development of research in practicality in the Food and Drug Administration. We have also in our Mental Hospital -- St. Elizabeth's Hospital -- the beginnings of research after a hundred years of activity in treating patients. So I think we may be able through the Secretary's Office to bring you, Mr Campbell, and your associates into touch with people who are in various stages of development of the organization and administration of research programs and that is, I think, something that may be helpful to you.

(Swinburne) I would prefer not to try to find a distinction between the art of architecture and the science of architecture. I would like to think of them both concurrently in solving problems in architecture. I also feel the same way about the disciplines; this is not new, it has been said here, but I don't want to think particularly in terms of sociology and then in psychology, or social psychology, or anthropology. I would like to think that all these things are united as they apply to particular architectural problems.

The art and science of architecture and all the disciplines, all working together and as one. The thing that has impressed me most about this Conference is not so much procedures or definitions nor specifics, as much as it is the arrangement of the groups of minds that are here. I have the impression as a practicing architect that I feel like a person in a hurry. I feel input material all around me waiting to go into something -- it isn't a computer, but it is in to me personally. If I had a wide range of all the knowledge that is around this table within me so that I could apply it to problems in architecture, I feel that the work we produce, which is the work of our office, would be immeasurably improved, but this is unimportant -- the contribution to society which we could then do would be improved. I would like to think that you'll all come back again somewhere, that you will be looking over our shoulder and saying you are not quite impressed and that we'd better get moving; needle us and say we are doing fair but we could sure do a whole lot more if we would listen to you.

This to me is the important thing.

The input that you people can bring to architecture is tremendous.

(Holley) My feelings on Tuesday, and I am sure they were shared by other members of the Steering Committee, were that I was hearing a replay, very much expanded it is true, of our early sessions in the Steering Committee: The breath, the range of ideas expressed, the considerable difficulty in finding a handle anywhere by which to get hold of this whole subject were all too apparent. I think the outcome of our deliberations, particulary as evidenced this morning, represents as much as -- perhaps more -- than any of us could have hoped for. But I think the really difficult thing now is to formulate and take the next step.

There is without question an immediate opportunity for certain specific types of research which have been mentioned here in the last few days. From what we have heard some of this research already has been initiated. But in terms of the next step I don't think the specific research proposals are the important things. What is needed now and what I am sure will be achieved is the creation of the proper climate (a) in the profession and (b) in the mind of the public.

(Hastorf) It is my impression that we would make an egregious error if we assumed that we had a random sample of the architectural profession with us here at this Conference. The fact is that we don't.

In general people believe in what they do, which leads to a sort of stereotype in behavior, and I think that the average architect trying to design buildings and trying to feed his family cannot sit down and contemplate many of the things we have been talking about.

I was impressed with one of Don Foley's points which he made this morning. He says he has un underlying faith that there are some essential problems that the architect has to concern himself with, which in essence are researchable. Now, I would like to mention just one more time the analogy to medicine because it is very apparent that the medical schools realized about ten years ago that they were turning out clinicians who were verging on becoming technologists. We have seen a lot of revolution in medical training and the major goal of it has been at the level of professional training to generate a real concern about medical research. I am quite convinced that an absolutely crucial step is that professional schools of architecture are going to have to try and generate that same concern. And this is not going to suddenly blossom--it is going to have to be generated at the professional school level where students will be introduced to it. The sort of activity that Don Foley engages in is going to have to become standard in schools rather than exceptional. With this sort of activity, if it can lead to generation of that concern for research then maybe we'll get somewhere.

(Campbell) I am glad this has been brought up again. One of our points of unanimity is on the subject of training, perhaps in a more limited sense than Dr Hastorf has mentioned, but I feel very strongly that it is one of the subjects to be attacked that emerges from this meeting

(Foley) I am very impressed with the fact that architecture, at least this representative group on behalf of architecture, is engaged in self-examination. I would hope that as a result of this the architects

that are here would by no means be discouraged. Sometimes we feel that other fields have these things all licked and we are the only ones in trouble. One of the things you do in group therapy is bring different people together who have troubles and pretty soon without anybody saying too much these participants realize that other people have these troubles, too.

I am terrible concerned by the motivation question. I feel that unless there is a reasonably clear recognition that within the profession there might be a distinctive training and career pattern for a certain number of persons in research and unless people have some sense that they are going to be rewarded for this activity and not be looked upon either as second class citizens within the profession or given the runaround, there is going to be great difficulty. I think this probably comes to a head within the professional schools where somebody has got to be able to run interference and not kid men along with, "Yes, you go ahead and do research and you'll get promoted." You've got to have assurance of this.

I don't know whether you'd call it tactics or strategy but I am convinced that the Committee here, through whatever structure AIA chooses to work within, does have to figure out certain specific next things that they can support or do. I guess my own philosophy suggests that the development is going to have an untidy aspect and beyond providing a climate in which you hope things will move, you are going to have to have a sense of patience about how much anybody centrally in AIA can do to move the whole thing along.

(Campbell) None of us is optimistic enough to think that this is going to move very fast. I am sympathetic with Swinburne's feeling of the need for action, for speed. We can push, and will push, but it is going to be slow. However, I think a very quick answer on the part of the AIA can be made through direction, through setting up a course to follow. A lot of it, as you say, is going to be inherently messy. But I think we can very quickly develop an approach to this question and determine a method of action.

(Taylor) I am very much encouraged by what Dr Foley said about patience and untidiness. The AIA as a Professional Society was 90 years old in 1947, when I was called out of practice in teaching twelve years ago to set up something which did not exist. I had to start from scratch, really, to set up a Department of Education and Research. I had very loose directives, just a few words on an organization chart. I do think we are approaching a break-through and am very much encouraged about the way this Conference has worked out.

Referring to Swinburne's remark about art and science--I am often worried about these dualisms so the way I resove Swinburne's dilemma is simply to say that art is the way of doing things; art is the application of individual informed judgment using the tabulated and demonstrated information which we call science. The scientist -- and increasingly the engineers -- are calling their work an art because after they have absorbed all the principles of aerodynamics or whatever it is, you come to the point where you've got to make a decision, and that's a personal decision and that's the essence of a professional man.

I can see at least a half dozen different ways in which the material out of this conference can be utilized, to get our profes-

sion more research-minded, in all the ways that have been mentioned, as public relations and into the schools, through our board of directors.

I have always been greatly impressed by the tremendous amount of valuable services and time devoted by members of the AIA to the advancement of the profession in local, regional and national committees, boards of directors, etc. While it is true that staff are hired to do a great deal of the leg work, paper work, etc., the value of the work done and even the possibility of its being done is dependent upon the contributions made by the members who reflect the desires and reactions of the membership, who give wise counsel and who alone can persuade the policy and fiscal authorities of the Institute that the committees programs are worthy of support and continuation. This has been especially true of the Committee on Research who have mentioned a strong, steady and well-informed policy regarding a subject which is widely misunderstood or disregarded by our membership, as has been noted in this conference. Chairman Walter Campbell has carried a large portion of this burden. Al Alschuler was one of the pioneers of the Building Products Registry idea in the Chicago Chaper and on the committee for that project. It is very encouraging and helpful to have new members of the committee such as Herb Swinburne carrying on with enthusiasm and contributory ideas. Reaching recognizable accomplishment by the year 1964 is much more possible because of the thinking generated here, the cross-fertilization taking place, and I hope we've got quite a few more friends in the other disciplines who are getting interested in architecture. Foley and Hastorf were bitten some time ago and I hope some more of you get bitten and really lie awake nights thinking about our problems and envolving some good ideas.

(Ehrenkrantz) I would like to add a note on the results of the survey conducted at the University of California on the status of architectural research in American universities: 48 out of 57 of the universities which have accredited schools of architecture answered the survey. 31% of the architectural schools who returned survey forms had completed one project which they considered to be architectural research. 50% of the returnees are now engaged in one project which they consider to be of an architectural research nature and 69% contemplate doing some work. I think that these schools and universities mirror the feeling of the profession that research in architecture is necessary and that this adds to the general note and tenor of the Conference.

(Campbell) We would indeed welcome and be very grateful for further thoughts and ideas and questions from the group. As Walter Taylor said, this isn't a one-shot effort and we would hope that your interest continues.

It is with sincere appreciation that on behalf of the Institute, the Committee on Research for Architecture expresses its thanks to the participants in the AIA-NSF conference, as well as to the members of the Steering Committee who responded so generously and ably in organizing this quest for knowledge towards a better total environment.

RESEARCH PROJECTS

SUGGESTED OR REPORTED BY CONFERENCE PARTICIPANTS*

METHODOLOGY

A master outline for advanced architectural research
Ways of financing architectural research, including development of public demand as prerequisite to substantial support
Modus operandi for interdisciplinary frontal attack on problem areas not taken as responsibility of any one science or profession, e. g. , disabled persons, accident prevention, etc.
Use of new techniques in systems or operations engineering
Role of schools with respect to research --development of research talent
(Current project): Policy statement on architectural research for the College of Architecture, University of California, Jan. 1959

COMMUNICATIONS AND DOCUMENTATION

Collection, classification and dissemination of past and present research findings
Information technology that will place at architect's disposal in usable form the enormous mass of available information he needs
Communication by architects with each other and with the public of major generalizable ideas developed in the course of designing a building
Study of architectural drawings, graphic arts and writing as a basic form of communication with the audience they serve--is there a better form?
Feedback of information from job investigations being made daily but lost in individual files
Architectural history--documentation of special building types
(Current project): "Building Science Directory" published annually by Building Research Institute, lists building industry associations, societies, organizations engaged in research--their research programs and publications

ARCHITECTURAL THEORY

Bridging the social and physical sciences: principles of transition from aspatial considerations to spatial arrangements
Kinds and sequence of information needed by the architect for design
Analytic concepts and techniques, including effective analysis of alternative design possibilities
Principles of the creative processes--thinking, reasoning, intuition and systems of alternative development
General rules of visual space perception and color phenomena applicable to specific design problems--an orderly rationale for esthetics as preparation for "the intuitive leap"
Use of predictive capacity of other disciplines to help present designs fit future needs; role of present designs in shaping the pattern of future living
Social responsibility of the architect to raise design standards held by the public
Clear statement of architectural theory, principles and objectives to encourage better practice and comprehension of architecture
The basic issues of civic design--enlargement of concept of scale and scope of design to include urban and regional design.

** A condensed list; not evaluated by the Committee as to value or researchability of any of the projects.*

FACTORS AFFECTING ARCHITECTURE

Design impact of the client
Crucial decisions and points at which they occur in evolution of architectural form
The effect of mortgage policies on architectural design
Impact of technological change on architectural design
Psycho-physical basis for color preference and selection in architecture
Physiological and psychological lessons learned from experiences with atomic submarines and space vehicles, and their application to building standards

(Completed or current projects):

Influence of climate on architecture. Princeton School of Architecture
Human relations considerations in the architectural design of offices. College of Architecture, University of California
The following projects at Engineering Experiment Station, Texas A&M College:

- effects of landscaping on natural lighting
- effects of sound on buildings
- solar radiation and its effects on buildings

ARCHITECTURE'S INFLUENCES AND EFFECTS

Bridge-building between physical and social sciences: effect of spatial arrangements on functional organization
Effect of major alternative approaches on people--large apartment and shopping centers versus traditional communities
A systematic basis for clinical research on relationship between physical forms and the goals they are supposed to serve
Use of psychological data in designing spaces to induce desired reactions, as for children, elderly people, the mentally ill, etc.
Constructed environments that have produced similar responses by peoples of various ages and cultures
Extent to which environment as created throughout history indicates evidence of conscious design effort--what part of conscious design philosophy is rationalization of an already determined form?
(Completed projects): "Space for teaching" and "Building for learning." Engineering Experiment Station, Texas A&M College

REACTION OF PEOPLE TO ARCHITECTURE

Effect of social and cultural forces on individual's perception and attitudes regarding the architect's end-product
Behavioral and emotional awareness and reaction to buildings, arcades, rooms, etc
Comparative study of conditions under which specific kinds or styles of architecture have or have not gained popular acceptance or acclaim
Analysis of fads and fashions that sweep across major building types
Systematizing predictable environmental reactions into known relations which, if built into structures, would produce desirable or avoid undesirable results
Elements of visual perception of color, space, scale, line and form
What natural values such as sunlight or grass, cannot be supplied by technological improvements--when may such natural values be ignored?
Psychological impact (perception) of cities (urban environment)
(Current project): Studies of form and color. Architectural Laboratory, Princeton University

EVALUATION OF ARCHITECT'S END-PRODUCT

Evaluation of completed buildings of various

types in the light of original objectives and as affected by influences exerted during program and planning phases
Methods of follow-up to determine how satisfactory any structure is
Feed-back of evaluation of completed projects to the architect
(Completed project): Measuring the quality of housing. Housing Research Center, Cornell University

ARCHITECTURAL TRAINING

New systems of education, appreciation and interpretation to improve society's understanding of architecture
Correlation between school training and the roles assumed by graduates as they work up in architects' offices
Better preparation of architects and planners for full range of opportunities and responsibilities involved in new operating scale, where large projects are built quickly by single organizations
Program and function analysis
Study of need for organized training in field of "architectural sciences"
Extent to which architects should become sophisticated in terms of existing psychological information
Use of sound films and cartoons in conjunction with model analysis and testing to teach architects the feel of what goes on in structures
Architectural aptitude testing
Development of research talent
(Current project): Cooperative study by AIA, ACSA and Educational Testing Service: Aptitude tests for admitting architectural students

PROFESSION OF ARCHITECTURE

Professional behavior of the architect:

image of the architect as held by the public--by architects
- characteristics of people recruited into architecture
- effect of training on the architect as a person
- analysis of the architect's role conflict (art versus marketplace)
- case histories of architect-client relationship

Issues raised by group practice or interaction between architect and architect, or between architect and specialists
Sociology of the architectural profession
Goals and methods for the architect to assume community leadership as a means of effecting needed environmental changes
Role of the architect in urban studies
The Architect's responsibility on behalf of "the public interest" as compared with merely satisfying the client
Criteria for true professional architectural services; conveying these criteria to society in intelligible form
Study of owners' preference as interpreted by developers of tract residential building --role of the architect in this field
Principles of management and sales relations applied to architecture as a business, especially to the problem of getting and keeping clients
A comparative study of methods of remuneration for architectural services
Adaptability of architectural profession to changing needs or revised interpretations of these needs
(Completed project): "The Architect at Mid-Century." 2-volume report of AIA Commission for the Survey of Education & Registration 1954

RESEARCH IN RELATED FIELDS

A Acoustics

Effect of acoustical treatments on the

quality of sound as distinguished from volume
(Current project): Effects of landscaping on sound, Engineering Experiment Station, Texas A&M College

B Economics

Economics of reusing plans for buildings
Comparative analysis of construction industry with other industries
Optimum balance of physical obsolescence of building components
(Completed or current projects): Planning criteria and methods for building conservation; a study of San Francisco as an example. College of Architecture, University of California
A study of the useful life span of school buildings, College of Architecture and Design, University of Michigan

C Environmental Health

Treatment of domestic, industrial and municipal sewage (no significant advances in four decades)
Problems of liquid and industrial waste disposal associated with increased demand for water supplies due to metropolitan and industrial growth
Control of water and air pollution by industry, including radioactive substances
The physics of environment: study of temperature, humidity, air movement, illumination and noise as a means of achieving physiological well being through control of mechanical systems, insulation, lighting and acoustics

D Planning

Design objectives in urban and suburban residential neighborhoods
Better patterns of urban land use--radial instead of concentric?
Predictable trends in community development
The planning process; how to make it more than a static and negative means of regulating what people are going to do anyway when they get around to it
(Completed or current projects): Perceptual form of the city, sponsored by Rockefeller Foundation at Department of Architecture, MIT.
Commuting patterns of industrial workers in the Northeast, Housing Research Center, Cornell University

E Psychology, Physiology, Anthropology

An approach to architectural design through exploration of anthropological factors and physiological relations
(Completed or current): Social and psychological aspects of home lighting. Housing Research Center, Cornell University
"The rise of shells" and "Psychology of shells." Articles in July '58 Architectural Forum

F Sociology

Analysis of occupancy requirements and trends as affected by rapidly changing technology

Effect of mobility on the character and role of institutions in the urban pattern
Effects of increased exercise of right of eminent domain due to increasing population and competition for land
Patterns for domestic life with extrapolation for 20 years hence
Social organization, organization theory and function of the client.
(Completed or current projects): Housing and social values; Farm housing in the northeast; Housing and human values; Housing for the aged; Housing Research Center, Cornell University

G Structural Design

Use of electronic computers and other techniques for more rapidly evaluating probable behavior of structural systems
Methods of studying realities of structural behavior that go beyond the mathematics and mechanics of analysis, such as model analysis and testing
Extension of ultimate strength and limit design concepts, especially to structural forms for which unit-stress solutions are not available
Behavior of materials in complex structural shapes and under combined stresses
Redetermination of design live loads and utilization of probability theory to achieve a more rational relation between loads and strength
Sequence and relationship of certain mathematical curves to problems in structural analysis and construction of buildings
(Completed or current projects): Development of thin-shell precast concrete roofs, College of Architecture and Design--University of Michigan
Research in stressed - skin structures, School of Design, North Carolina State College
"How firm a building foundation," article in August '58 Architectural Forum, describes research at various universities on soil behavior

H Unclassified

Transportation techniques encompassing movements of people, goods, messages and ideas; their purposes and relation to land uses
Composite studies of units of major building types in which a number of variables are kept unchanged while one of the factors is varied
Design criteria for various building types, methods of determining such criteria
(Completed project): Studies of Organization of the Home Building Industry, Institute of Engineering Research, University of California

Research For Architecture

Condensed Report of An AIA Conference
Supported by The National Science Foundation
Ann Arbor, Michigan
March 10-12, 1959

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A · I · A

Reprinted from the September and October 1959 issues of the

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1735 New York Avenue, N.W., Washington 6, D. C.

FOREWORD

The AIA-National Science Foundation Conference on Research for Architecture resulted from long-time explorations, by the national AIA Committee on Research and the AIA Department of Education and Research, of needs and the status of architectural research. It was significant and gratifying to find the National Science Foundation was willing to support our search for the fundamentals which will underlie all research for architecture.

For the membership at large it should be recalled that the principal aim of the Institute with regard to research is to provide practitioners and educators with more and better tools for the design and planning of finer buildings and communities in every sense of structure, function, esthetics and economy. To this end the AIA set the following goals. They are:

- *AIA accepts responsibility for and will do research for architecture.*
- *the Institute will encourage other agencies to develop and carry out building research.*
- *the Institute will develop means to make results of research available.**

The conference was largely devoted to the subject of the first two items. Number three is well under way through services such as the Building Products Registry and the projected Index of Architectural Information.

It was recognized early in the work of the Committee on Research that the fundamentals—knowledge of man, his needs, aspirations, behavior and abilities—knowledge of total environment and how best to help plan it—were areas outside those of the profession of architecture. As a result, advice was sought from other sciences as well as from architects and the following representatives were appointed as a steering committee to organize the AIA-NSF Conference: Architecture: Bloomfield, Campbell, Pawley, Swinburne—Sociology: Foley, Merton (Columbia)—Structures: Holley, Nordby (NSF)—Planning: Kelly—Environmental health: Yaglou (Harvard School of Public Health).

As a result of long study culminating with the conference, the AIA Committee on Research for Architecture is preparing an operational research program and organization for Board approval at its autumn meeting.

Architectural research will be expensive and beyond the means of the profession for its sole support. However it is essential that the profession show its belief by modest financial support before we can enlist the aid of consumers, foundations or any other money source.

We are not embarking the AIA on any long-haired or unrealistic program of research. It is being developed with the conviction that it will prove of practical value to the individual architect, will increase the effectiveness and hence the prestige of the profession as a whole both in performance and leadership.

This digest has been written and edited (a prodigious task) by Walter Taylor, Eugene Magenau and Eric Pawley of AIA Headquarters staff. Full proceedings of the conference are being prepared for separate publication.

WALTER E CAMPBELL, FAIA
Chairman AIA Committee on Research for Architecture
General chairman AIA-NSF conference

*For amplification see AIA Journal (August 1958) report of Cleveland convention seminar on research.

Additional copies of this reprint may be ordered from The American Institute of Architects, 1735 New York Avenue, Washington, D. C., attention: Document Division. Price $0.50. The full Conference Proceedings will be available in late November, 1959. Price $3.00

A recap of significant findings

The first conference on research for architecture considered:

- contributions and relationships of other disciplines to environmental and esthetic design
- criteria for future project proposals and support

There was general agreement:

- on need for such research
- on lack of trained personnel and current inducements
- on use of existing buildings for case-studies and data on failures
- on need for long-term support and continuity of cross-discipline meetings
- on avoidance of rigid definitions of basic and applied research

Brief findings follow, in each of the six conference subject-areas, as discussed by participants:

Architecture

Architecture is a creation of a total environment within which can be accomplished the aspirations of man. We need a center and organization for *research for architecture* as well as studies at existing schools.

Architect's design responsibility is not the whole story—there must be studies in sciences underlying architectural practice (including economics) and clinical research in architectural theory.

Research may be of two kinds:

- *passive:* to make available predigested information
- *active:* new information and original thought to give depth and perception to design decisions and alternatives

Greatest professional challenge faced by the architect is that he finds too few clients of discrimination. Is it his social responsibility to meet low standards or to exert himself to better a performance which is neither understood nor valued?

Structures

Need better communication between architect and structural engineer — whither architectural form? Increased use of model analysis is stimulating structural research. Architect needs familiarity with new structural concepts.

Need studies of complex interactions of composite structural materials and how to analyze structural form cut loose from the stress-concept.

Psychology

Architects and behavioral scientists must learn something of each other's methods and data already on hand—must apply themselves to realistic problems.

Need study of organization-client—a vacuum of knowledge about social functioning of organizations. Architects should take responsibility for *shaping the future* and not feel that they must *conform* to a sociologist's prediction of it!

Forget sharp boundaries between disciplines. Avoid current fallacies of *team* and *project* research—people who agree to agree are not going to get very far in research. You cannot decide what you are going to prove. You cannot *plan* research.

Sociology

Need studies in architectural theory (professional practice theory), quite possibly non-academic in method and including relationships of *individuals, physical and social environment.*

Esthetics is least-developed area in sociology and psychology.

Planning

Conceptual or design responsibility of the architect has been outrun by technology. Designs are solutions of hypotheses—how can we research or teach in this field?

Problem-solving approach to creativity has been tradition. Need to define architectural problems in clinical terms in order to get help from other disciplines—or to develop the profession's own research talent.

Architectural research efforts and support should be centered on architectural problems—city planning, for instance, currently has some recognition and support. Scope of design must be enlarged to help clear up the urban mess.

Architecture deals with problems and management of space, and needs evaluation of factors of environment. Basic fact is that you cannot plan without an inventory.

Do not confuse measurability of a research subject with its ultimate importance.

Environmental Hygiene

Research experience in this field offers profitable suggestions for architectural research.

Considerable evidence of induction of behavior by architectural form. There is an analogy with the nervous system.

Public demand creates support for research—which must be long-term.

KEYNOTE SPEAKERS AND DISCUSSANTS

ARCHITECTURE

Architecture—a redefinition

Herbert H Swinburne, AIA,*** Philadelphia

Comments on the nature of architectural research

Harold D Hauf, AIA, Troy, NY, Dean, School of Architecture, RPI

Man—the root of research

John Lyon Reid, FAIA, San Francisco

STRUCTURES

The architect's role in structures research

Myle J Holley, Jr,** Cambridge, Mass, Professor of Civil Engineering, MIT

Materials, influence on structures

Albert G H Dietz, Cambridge, Mass, Professor of Building Engineering, MIT

Research by observing & recording defects

Fred N Severud, NY, Consulting Engineer

PSYCHOLOGY

The behavior of the architect: process & product

Albert H Hastorf,** Hanover, NH, Professor of Psychology, Dartmouth College

Discussion

William H Ittelson, NY, Professor of Psychology, Brooklyn College

Stephen A Richardson, NY, Assistant Director, Association for the Aid of Crippled Children

SOCIOLOGY

Architectural research from a sociological perspective

Donald L Foley, Berkeley, Calif, Associate Professor of City Planning & Architecture, University of California

Discussion

Glenn H Beyer, Ithaca, NY, Director, Housing Research Center, Cornell University

Guy E Swanson, Ann Arbor, Michigan, Associate Professor of Sociology, University of Michigan

ENVIRONMENTAL HEALTH

Environmental hygiene & its meaning for architecture

M Allen Pond, Washington, DC, Assistant to Special Assistant for Health & Medical Affairs, US Dept of Health, Education & Welfare

Discussion

L P Herrington, New Haven, Conn, Director of Research, Pierce Foundation and Dept of Public Health, Yale University

Douglas H K Lee, Associate Scientific Director for Research, Quartermaster Research & Engineering Command, US Army

PLANNING

Planning and science

Burnham Kelly, AIA,** Cambridge, Mass, Associate Professor of City Planning, MIT

Discussion

George B Cressey, Syracuse, NY, Department of Geography, Syracuse University

Research in city design—a suggested program

Henry D Whitney, AIA, NY, Planning Engineer & Consultant

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► The general subject and the basic papers were thoroughly discussed by prepared discussants, the conference in assembly and by six discussion groups. The following summary is categorized under the topics which emerged, regardless of source or actual sequence.

Background

Architectural research is not new. In the eighteenth century French architects met regularly with the king to discuss architectural problems. It would be incorrect to assume that no architectural research has been accomplished. The serious interest of the AIA was manifested by the establishment of the Department of Education and Research in 1946. This Department and related committees have a considerable experience and accomplishment in many aspects of research including conferences and publications on documentation, building-type and technical reference guides, sponsorship and guidance of research on hospitals, mental hospitals, rehabilitation centers, technical studies on illumination, the guidance of industry-financed research through Research Advisory Service, etc.

However, this was the first conference involving both the related social and physical sciences and addressed to research for architecture as distinct from building research.

Purpose

Objectives are:

- to analyze relationships of the physical, biological and social sciences in the problems of optimum-created environment for human activities
- to define needed basic research—both in independent fields and in composite interaction
- to establish criteria for architectural research through which projects can be authorized and supported
- sharing of knowledge now available and to come, on a continuing basis

If architects can come to grips with techniques and possibilities of the behavioral sciences they will know better how to do what they must do. Architecture deals with planning, esthetics and human-focused requirements which cannot be accomplished without knowledge of how people behave.

Should the architect give his client a service which meets the suspected low standards of the public or should he perform to more demonstrably valid standards which may be neither understood nor valued? Means must be found to make research results known and intelligible to the public.

Architects should not be trying to guess the future in order to conform to it. They should face up to the responsibility for shaping the future. Design of structures and communities can actually change patterns of living.

Definition

Scope of research and range of resources would be better recognized by the title *"Research for Architecture."* This will avoid splitting hairs over whether research is accomplished by architects or others. Contributions to medical research are made by numerous specialists, not by practicing physicians, similarly for civil engineering, etc.

It is futile and unnecessary to define precisely the difference between basic and applied research. There are certain characteristics of basic research such as its general nature, its relation to several problems (not an answer to one specific problem), no specific end-product, possibilities of accidental discovery.

Other distinctions in research are considered more important: operational or service activities to improve efficiency of professional operations vs contributions to knowledge which would give greater depth and perception to design determinants.

It was repeatedly emphasized that an important and neglected area is clinical research or investigation of the actual use of completed buildings checked against the original assumptions and standards. Such clinical research would yield information not only for design of similar structures but for the design of research situations for more precise investigation.

Architectural forms and spaces will themselves produce individual and group behavior susceptible of research including the relation of the architectural design to the induced behavior.

Advance collaboration between designer and researcher could facilitate setting up of variants and control situations for later investigation. Ar-

chitects should develop theories or hypotheses derived from general professional experience to be tested by researchers in appropriate related fields.

There was the customary concern that research might attempt to reduce creativity to formulas. It was generally agreed that this is impossible and the effort undesirable. There was agreement that science makes use of intuition, that distinctions between science and art are not precise or valid and that research can greatly improve and refine the architects' tools for design and self-criticism. Intuition is the individual's process of organizing and collating, with imagination, knowledge and experience previously accumulated. This background can be made deeper, richer and more precise by research.

The approach to human needs to be met by architectural design will require precise distinctions between values, preferences and attitudes and recognition of the differences between those of the architect and his clients. There are also varying rates of change of values, professed values, preferences, attitudes all relative to obsolescence of the building and the effect of the building on values and organization.

In view of the broad scope of research considered by the conference, building research should be regarded as a subdivision of architectural research and not the converse.

Evolution and Transition

"The architect is building on a past which apparently nobody liked, he is building for a future which no one in the world can predict, and he is building in a present which is so transitory as to be almost irrelevant."

Acceleration accelerates. The magnitude of change is greater and the rate of change is swifter. The construction industry however is just coming to a realization that it is one of the few remaining industrial frontiers, which has been preserved by barriers of failure of communication and traditional points of view. It is preserved in an outdated form but still regarded as a prime area for venture and gain.

Engineers have found that empirical or pseudo-scientific training is inadequate to cope with today's highly scientific and complex problems. Now the architectural profession is beginning to realize that it will have to do more research if it wishes to stay in the area which is its prerogative.

Architects' attitudes are changing from the former alleged artistic detachment to a different professional frame of mind which regards the bones, intestines and arteries of their buildings with genuine interest and even with the speculative eye of the artist.

Two architectural fallacies are being reconsidered. First, the worship of structural considerations to the virtual exclusion of others equally necessary, and secondly, the deification of the intuitive or individualistic approach to design.

Some presently available materials have few inherent limitations of form, or imagined limitations, a situation which is leading some designers to make a fad or fetish of form. There is also a preoccupation with combinations of sticks, webs, spherical-triangle and warped-surface structures into which nonconforming program requirements are being forced.

Communication and Documentation

There was unanimous agreement in the conference that the classification and recording of research information is the number one priority—its modest beginnings can be expanded without delay—it is a necessary prerequisite to any new research.

It is generally known that a great deal of research applicable to architecture and the building industry is being carried on and much of it reported but at no one place is there a clearinghouse recording, abstracting, reference and reporting service.

In addition to formal and programmed research, there has always been a certain amount of specialized research in or under the auspices of architectural offices in advance of design. There is a considerable quantity of this valuable information which is possibly used once, filed in the original offices and never reported. Architectural journals, rarely report research. A demand for this type of publication should be developed, with prizes for the best technical papers.

The recording and wider publicizing of research findings would help in the penetration of authoritarian barriers of codes, regulations and standards which interfere with use of new scientific knowledge.

It will be essential to establish some criteria and limitations. There are 60,000 regular scientific periodicals published in the world which contain an unknown quantity of new knowledge applicable to controlling environment for the benefit of man. Much can be learned from other disciplines.

A specific program could explore the general area of impact of architecture on the public. Seminars with existing learned and professional societies in joint sessions would be mutually beneficial,

with presentation of sociological and psychological problems to architects and the converse. Interdiscipline study-groups are already being set up in some institutions.

Education

Schools of architecture should be encouraged to utilize existing staffs and facilities more fully to identify areas of desirable knowledge in other fields useful to the architectural profession.

The major goal of a revolution in medical training has been to generate a real concern about medical research on the part of the practitioners and the profession generally. An essential step now is that professional schools of architecture do the same. It will not blossom suddenly.

The following principles relate research to architectural education:

- the university school of architecture is the natural breeding and training ground for research personnel
- architects to be effective must have relatively complex knowledge and appreciation of sciences outside their immediate professional scope
- architectural students must be brought into contact as early as possible during their training with sociological and psychological problems and related research
- social science-related research in architectural schools can best be taught by the presence of faculty members engaged in such research who can gradually interest and involve graduate students in their work

Architects are not trained or experienced in reporting and publishing as are men in most of the scientific disciplines. This is a problem in the education of architects generally and in the training of researchers.

There should be more research-minded professionals in the faculties of the schools of architecture, not only to train researchers but to develop in future practitioners a receptive and supporting attitude toward research and research findings.

Deans of schools of architecture should be urged to emphasize research contributions and the development of research abilities of their faculty members.

Finance

Good research is costly in time and money and leads to more research requiring more funds, but from an overall point of view research is exceedingly cheap when taking into account all of the costs of trial-and-error design, construction, operation and maintenance. In the life of any kind of a product, research is certainly one of the cheapest investments in terms of the total return.

More difficult than getting money is finding ideas for research proposals of good purpose, for which money is available. The architectural profession has not yet brought its purposes before the public, as medical research has done, to show their importance.

Organization

While the architect is the coordinator of many technologies in building design, it does not follow that his position in research is necessarily analogous.

It is of utmost importance that the research program be planned with a longer life than that of any committee.

One function of a central research organization would be to select and clarify problems which could be researched and reported for the benefit of a great number of architects and their clients—to act as a central architectural research intelligence agency collecting and disseminating status reports on current research projects.

There were differing opinions about a large central research organization—better progress may be made faster by developing existing research resources than by setting up a central bureaucracy. Research should be decentralized according to human resources and available facilities. A research center could serve only for coordination, documentation and the avoidance of duplication.

Research Personnel

Obviously it will be necessary to encourage and assure adequate training and numbers of architectural research personnel. The training would include apprentice experience in ongoing research with encouragement to persons trained in architecture to pursue further education in selected branches of science with financial assistance in the form of scholarships leading toward doctoral degrees.

Architectural education is already to a considerable extent clinical and incorporates some features that would be called research of a simple sort in some sciences.

It would be necessary to provide motivation for architects to do research with no stigma attached to non-practicing architects so engaged. There

may develop a new type of consultant, a consultant for architects. There are architectural offices which have professional researchers and librarians.

The architectural profession might take a clue from developments in applied science. A need has developed for personnel who can cope with the overall problems of complex systems, who can grasp the entire picture and synthesize the various elements involved, making use of relatively new and exotic areas such as linear and dynamic programming, information theory, and a host of other relatively new areas and techniques. In engineering the man is known as systems engineer or operations researcher.

Program

The conference did not have as its objective the precise formulation of a program but numerous suggestions were made.

A lot of available knowledge is not put to use. These contributions of other sciences could be dealt with by a series of steps:

- recognition that there is a basic body of knowledge—a sort of working capital which is utilized whenever we seek the answer to the specific problem
- find information, assemble it and bring it to those who can use it
- when information needed to solve a specific problem is not available, undertake an investigation

Architects are concerned with the organization of space. This should be not only within four walls but all around the globe. The natural conditions of space vary greatly in the inhabited areas of the world and if we are to design space properly for man's use we must recognize the variations. We need to broaden our horizons and not limit ourselves to structures and certain institutions but look at the entire nation and the entire world.

You cannot plan until you have finished the inventory. Almost everywhere we need better and clearer goals and a greater sense of meaning and design in our lives and in our environment.

Our national life focuses in metropolitan areas which should be the special province of the architect. Architecture is the art and science of space production and a city is the environment in which space is most at a premium and where its proper location and ordering is most needed and appreciated. We must identify the vital research needed by the city if it is to become livable again.

The complexity and difficulty of some of the proposed research should not be overlooked or minimized. In many respects the behavioral sciences are not yet equipped to answer direct questions. In the social sciences it is difficult to get independent controllable variables.

From observation of what has actually been done and the choices which people make from what is available, there can be developed a kind of actuarial knowledge in terms of the behavioral sciences and physical conditions. The clinical process followed in medicine should be followed in relation to building design, not only for analysis of structural failures but in terms of the social and occupational functioning of the building.

This kind of knowledge will make possible connections between architects and scientists. Esthetics should be one area in which sociologists and psychologists might make a significant contribution although it is one of the least-developed areas in these disciplines.

It is not necessary to wait for a fullfledged research program in order to start. We can develop a group that can cull information from the research which is right here in buildings. There is full-scale research going on right now waiting to be tapped, recorded and reported.

Nothing will happen until someone says "Let's go." We may make some false starts and have to come back. This action should have central guidance and advice from those who are already deeply engaged.

ABSTRACTS OF PAPERS

Six basic papers were prepared and distributed to all participants in advance of the conference. They were the subject of special comments by prepared discussants and general discussion by the entire conference and by discussion groups. The papers are here condensed to thirty percent.

Herbert H. Swinburne:

Architecture—A Redefinition

► In a century and a half of Webster's definition of architecture changed from "art of building" to "art or science of building"—one word symbolizing the effect of the Industrial Revolution. From sticks and stones of shelter by sophisticated manipulation of science and technology come twentieth century buildings.

Architecture is well understood and appreciated visually as separate buildings, functioning assemblies of materials and equipment.

Concept, definition and practice are too limiting, too much emphasis on physical structure, too little understanding of man, society and the true role of the architect.

Man has constantly altered his unsatisfactory natural environment. Today in most areas he manipulates sections of it for his comfort. Eventually he will completely control total environment. The needs and purposes of man living in society are the controlling factors, relating to his ultimate goals. Architecture, then, is not merely the art or science of building; it is the creation of a total environment for accomplishing the aspirations of man.

Redefinition and research

To build wisely and efficiently for man we must study him individually and collectively. The physical sciences are studied incessantly but aspects of the behavioral sciences affecting the shape and use of architecture are little known.

A century of industrial revolution changed architecture irreversibly—a century of social evolution will have farther-reaching effects.

Adapting in years rather than centuries, changing society demands a new environment. Magnitude and rate of change accelerate, affecting architecture and professional practice.

While constructing vast containers for all people, all activities, the architect must be knowledgeably sensitive to their needs.

The architect, trained as a generalist, must encompass more and more knowledge of many diverse fields and apply their principles to buildings, space between, to cities and regions as he creates new environment, leading in the creation of a vital dynamic quality.

To participate in the sense of destiny, of people moving toward goals of a better society, the architect must embark on an accelerated program of professional research, knowing that he, being uninformed in this vast field, will need specialists from all disciplines. Integrated directed research is necessary now, and ten years late.

Architecture—Structure of the Creative Process

Architectural research begins with relating the subdivisions of architecture to each other as in practice, also to all assisting fields of knowledge. Each well-defined segment is a potential research area, some "architectural," some "building" research, some possibly not previously regarded as researchable.

A research network relates researchable facets of architecture to the knowledge of man. The profession and society are linked by a communication system, which should be researched for improved mutual understanding.

Architecture—Elements of a Research Network

More detailed analysis* lists sets of elements for each segment of practice and other disciplines, perhaps unconventionally aligned. This permits tracing the relationships of one element to others in architecture and through a research network to other branches of knowledge, revealing much knowledge useful to architecture and to architectural research. Such graphic analysis discloses a variety of relationships and overlaps.

Research—Needs and Priorities

Areas of needed research may be classified in three categories originally suggested by Dr Robert K. Merton:

- problems in architecture generated by society
- problems generated by ongoing experiences in architecture
- problems of the place of the profession of architecture in society

(Fourteen research subjects suggested by Swinburne will be included in the compilation of recommended subjects in part II of this report.)

Research—Frontal Attack

By 1960 industry will spend ten billion dollars per year on research and development. Those who do no research are soon outpaced in science, industry, government, business, education—and architecture.

Construction is a $50 billion per year industry. Millions are spent on materials and building research and product development but almost nothing on basic architectural research.

A belated reasonable minimum program would include:

- Research Study Group (Headquarters Staff) location determined by best access to related disciplines, a leading university and school of architecture

  staff under a research administrator in liaison with AIA, to include ten most competent researchers from various related disciplines

* presented on large charts at the conference.

The study group, exploring general problems in architecture, would perform some research and would develop methods for cataloging, abstracting and disseminating all architectural research in that performed by others.

- Contract Research

  The study group would allocate and monitor research contract projects, minimum four per year, with various universities.

The difficult field of integration of disciplines might be the subject of an early research project. Relevance, clear definition of purpose, high calibre of personnel and mutual understanding of roles are all essential.

Research and Cost

Good research is costly. It must be supported by those who are benefited, the profession and the public. Over a long period, donated time by individuals and universities might produce results, but in terms of special interest—not meeting the needs of the profession.

The study group headquarters facilities with overhead and supporting staff would cost $35,000 per principal researcher. University contract costs vary widely according to scope and subject.

Research and Time

No research program is predictable and only one project in eight is successful. Five years would be required for organization and accomplishment of the first significant results. ◄

M. J. Holley, Jr.:

The Architect's Role in Structures Research

► Factors which demand cooperation sometimes create misunderstanding and frustration—the architect trained to conceive beautiful and useful structures, his necessary breadth of viewpoint precluding mastery of many disciplines involved in final creation—the structural enginer called upon to judge capabilities of a proposed form or provide a supporting system within it.

The relationship between architect and structural engineer may be more delicate than that of architect and other specialists. The proposed structural form may be the essence of the architect's creation—to the engineer it may be illogical, impractical or even impossible. Harmonious cooperation is more typical, but frustration or conflict may be intensified by the degree to which architects and engineers practice each other's roles and thereby acquire a real or imagined competence in the other's field. Each may overestimate the range of situations for which his talents are adequate.

Cooperation between architects and engineers, often productive of outstanding designs, may be strengthened by structures research. Progress can be accelerated by recognizing the interdependent interest of both in indicating major problems, research objectives and methods of attack, leading to improved communication between the two professions.

The engineer requires better understanding of certain aspects of structural behavior and better techniques for evaluating probable behavior of specific hypothetical systems—to enable him to provide prompt judgment and perhaps specific guides which will increase the frequency of favorable judgment.

Promising areas of structures research may be indicated by comparison of conventional philosophy and significant modifying trends. Development of structural engineering has been dominated by the "unit stress" concept. Mathematicians, elasticians and structural analysts have labored to produce techniques for evaluating internal gross forces and the unit stresses in a variety of complex assemblies. Familiar concepts and terminology for acceptable strength-stiffness behavior are:

- a useful range of nominal unit stresses related to elastic limit values
- working loads
- structural analysis to determine thrusts, shears, bending moments, etc

Benefits of this approach have been: practical methods and criteria applicable to most structures, wide acceptance based on good service records permitting codification and the training of vast numbers of engineers.

Where the demand for a specific structural form has been sufficiently insistent and its merit obvious but the analytical tools inadequate, the engineer has utilized test data and judgment to formulate empirical design methods, still expressed however in nominal unit stresses.

The state of the art and science has constantly lagged behind the needs of structural designers.

Recent developments indicate that the unit stress concept is too restrictive—that it is but one approach.

There is no implication of inability of the structural engineering profession to cope with problems of building design in the present era.

Rather—research is needed to insure that the grasp of architect and engineer alike shall not be needlessly shorter than their reach.

More specifically the following areas are suggested, with no implication of unimportance to others omitted, which do not reflect basic changes in concept or method:

- Application of *electronic computers* to stress-analysis of structural forms for which known methods of stress-analysis have been too costly. This tool will also permit computation and tabulation of stress solutions for recurring forms. Under some circumstances the computer can be asked to select an optimum design for given criteria. There is no reason to fear that man's creative and analytical talents will be supplanted. The computer is an infinitely superior slide-rule. A preliminary architectural research objective would be the definition of recurring forms of greatest interest.
- Extension of the *ultimate strength and limit design* concepts. While not practicularly new, recent progress has been rapid, but the terminology and assumptions are not completely logical.

  The ultimate strength concept:

  - dispenses with unit stress criteria
  - was adopted as alternate method by ACI
  - is a first step toward limit design

  Limit design implies:

  - proportioning of entire structure for collapse of the whole at a specified multiple of working load
  - this concept eliminates unit stress criteria and elastic analysis for internal gross forces
  - AISC specifications and ACI code will soon permit use of this method

  These new concepts have been applied mainly to relatively simple forms which were as easily handled by conventional methods. Of greater significance is their probable future application to forms for which unit stress solutions are *not* available.
  While architects may not be directly involved in this area of research, they should learn to think in these terms, for improved communication with engineers, and in relation to the following research area:

- *Utilization of Probability Theory*

  In conventional design there is generally no attempt to relate the factor of safety to specific conditions. The use of ultimate strength criteria rather than unit working stresses permits a more rational specification of factor of safety. Computed ultimate strength can reflect probable uncertainties of material and degree of quality control. Choice of load-factors can be based on the probability of developing particular load intensities during the life of the structure.

  This approach, little-used to date, offers more rational load-to-strength ratios. Probability theory is mathematically well established. Indicated research is toward better definition of probable loads.

- *Model Analysis*

  Constantly improving capability for analytical evaluation will never meet demands imposed by newly devised forms. Model analysis may be the required supplementary technique. Considerable research effort will be required, architects contributing suggested forms for general model analysis. Corollary advantage would be a better understanding of physical behavior of a variety of forms. ◄

M. Allen Pond:

Environmental Hygiene and its Meaning for Architecture

► Sanitary or public health engineers, like architects and city planners, must have considerable knowledge about, and ability to relate, many seemingly disparate kinds of knowledge in manipulation of environment for the protection and improvement of public health and safety.

The architect's principal objective is to give form to ideas and concepts that are not readily—if at all—made tangible by others. He, therefore, like the practicing engineer and physician deals primarily with the products of research.

The advancement of environmental hygiene has been largely dependent upon progress in utilizing the products of a variety of research efforts. The rate of progress in architecture will be no faster than the rate at which empirical or scientific knowledge is accumulated and applied.

Society still lacks the precise knowledge that will be necessary to bring many of the psychological and physiological impairments of man under control. Architects and planners have a major stake

in—if not responsibility for—efforts to expand knowledge about relationships between environment and the health of man.

The impact of sanitary science on society

A clear relationship exists between the control of water-borne disease and urbanization. No community can develop and survive without potable water. The full flowering of great metropolitan areas is more and more threatened by absolute shortages of water. Some of us will see cheap energy making it economically feasible to use sea water for domestic, industrial and agricultural purposes.

However as more water is used the problems of disposal of sewage and industrial wastes grow and become more complex and serious, including waste from new compounds used in industry. There have been almost no significant advances in urban sewage treatment, efficient disposal of refuse or control of air pollution and radioactive substances.

These problems will be of increasing concern to architects and city planners. While the profession is not equipped to make fundamental contributions to the needed new knowledge, which is more likely to come from physical, chemical and biological sciences, architects, planners and sanitary engineers can serve a useful catalytic function by constant stimulation and encouragement. They must press for solutions if their own efforts to improve the living and working and recreational conditions of man are to be successful.

Blueprinting a research program

The basic difference; *research* involves a diligent search for knowledge; *technology* has a definite end-product target. Research in any field is an evolutionary process—it is impossible to predict where a given line of investigation will lead, and there is never an end-point. Research may not only result in useful products—it may create additional problems, such as insects developing resistance to DDT. Unless aimed at certain broad targets, the design of a research program may be frustrating.

For the foreseeable future, public officials and scientists will together play a leading role in organizations of the nation's major research efforts.

Popular appeal is very significant in the competition for the research dollar. The public interest in research on cancer and other dread diseases and in space and atomic research is much greater than in environmental hygiene. In the long run the by-products of well-supported research will contribute to environmental control and design—the sanitary, physiological and psychological lessons from an atomic submarine full of men submerged for weeks, or the experience of AEC research centers with ventilation, waste disposal and air pollution applied to design of typical buildings.

We are approaching the threshold of public interest in the social sciences, of concern to the architect. Architects are more likely to make useful contributions by finding ways of applying new knowledge as it becomes available. The profession must rely on the leadership of various professions and disciplines to cooperate in a common search for knowledge and must prepare to work closely with the scientific investigator.

One of the most important gaps is the lack of efficient machinery for the winnowing of new knowledge for utilitarian purposes. Architecture should use its resources in stimulating and supporting efforts to speed efficient use of new findings from research conducted under other auspices.

Two other possible approaches, not mutually exclusive:

- the architect—like the engineer and the physician—will require intensive training in one or more branches of basic science if he is to enter actively into scientific research
- organization of machinery to bring broadminded and understanding members of the scientific fraternity into close and regular contact with the architectural profession

A successful example: the Committee on Hygiene of Housing of the American Public Health Association utilized first-rate scientists and broadly experienced administrators. ◄

Burnham Kelly:

Planning and Science

► To understand the impact of science on the design professions, their concerns may be divided into design and construction. Most scientific effort has focused on tangible, visible, lucrative construction. However, true science is rare and its effect on design diffuse.

Science in Construction

Our best scientific brains can rarely be interested in normal construction where the bulk of needed information has long been known and presents a pale challenge compared to electronics, nucleonics, space travel. Industrial potentials in the construction field are vast and significant developments have been carried on, but the field is not rich in scientific brains.

Still farther removed from the scientific base are building regulations. Science is predigested in the regulatory process or the equipment engineers' rules of thumb. For the average architect and planner and developer, the pipeline to scientific truth is the building code, zoning ordinance, subdivision regulations or FHA requirements. If a fundamental fact has not penetrated these un-sound-barriers, it may as well not exist.

The designer's understanding of construction is shown in working documents prepared by hired specialists, who are not regarded as designers, to meet the practical situation of the immediate job.

Final construction decisions are made at one more remove from the scientific base. Facts of cost dominate the horizon, blocking the view of potentials and innovations. A penny saved today is nowhere more valuable than in the construction industry, where one might expect a broader interest in performance over the life of the project.

There is far too little exploration up and down the series of separations of construction from science: The specification writer does not look behind the codes—the code writer uses only current engineering practice—the engineer rarely ventures outside a narrow well-exploited special background.

Major improvements based on scientific advances can be put into effect only when a designer sees the process whole. The most pressing problems will receive scientific attention only when there is feedback from firing-line experiences.

A false sense of concreteness is given to certain details because they can be analyzed and dimensioned.They exert undue design influence and there is strong suspicion of pure fashion as new bits of knowledge become "must" design features—solar geometry is no more important than artificial illumination considering hours of use.

Science and Design

From Vitruvius to now, designers have attempted systematic analysis of the design process. Why has it apparently stopped?

Construction technology outran design theory, demolishing old ideas and leaving insecurity. For many, design in an industrial civilization is simply the consequence of construction. What is possible within cost, codes and time limits is good because it is possible. A more refined version: Assuming that the basic use function can be generalized and expressed, a construction by which it is expressed is *ipso facto* good design. In neither case is there concern for a scientific basis for the design process.

A determinist fringe of science-awed designers suggests in effect that when all necessary facts are known, the variables may be fed into a great computing machine from which emerges the answer.

The opposite school believe that only the intuition may be trusted and that science has nothing to do with design. If intuition means a creative insight based on general background and experience, it is at least as much needed as sound construction knowledge. Intuition and science are not at opposite poles. The history of science shows that some important original scientific advances were the result of instinctive certainty working through very unscientific procedures.

An important role of design is to postulate from a mass of intangible and little understood experiences, hypotheses or solutions for which scientific tests may then be constructed and carried out. The essential feedback to the scientific world barely operates now because of communication obstructions and the difficulty of setting up experimental and analytical studies.

A first requirement is a summary statement of some problems in clinical terms. The difficulty of developing a systematic approach does not justify the conclusion that the only effective tools are intuition and political compromise. If rigorous systems of analysis can be developed, the practicing designer can get effective help from the scientist, both having better ideas of the kind, purpose and degree of reliability of assistance required. However scientists will not gamble time, scarce funds and professional reputation if they believe that the effective determinant will after all be the designer's intuition, the non-conforming findings of science to be damned.

Suggested problems at the urban planning scale: the perception of cities; a skilled investigation of the complex and dynamic urban environment, of city impressions of various kinds of people in different activities, in various parts of the city at various times and seasons.

The nature stereotype in the mind of urban designers: study of the high values placed on fresh air, sunlight, green areas, trees vs the possible substitution of artificial conditions. How important are the natural phenomena socially and biologically? What cost of adaptation to the artificial?

A nation of nomads: the future relative importance of fixed real property vs movable personal property (furniture and automobile). The home and neighborhood as major stable elements in fluid pattern of life. Possible advantage in design for efficient functional services vs gratification of individual preferences.

Institutions: the character and role of schools, churches, hospitals related to mobility and urban pattern changes.

Optimum scale: of shopping centers, industrial parks, suburban residential communities, etc.

Industrialization of construction operations.

Few architects, planners, builders or regulating officials are prepared to handle the full range of opportunities and responsibilities involved in the new operating scale, or to appreciate the degree of the resulting environment change.

The problems are difficult and concern broad objectives. Difficulty and honest frustration are preferable to the false security of irrelevant concreteness and of traditional disciplines.

Research should seek to gain for design the full benefits of scientific advance now filtered out by the customs of engineers and the prejudices of administrators. ◄

Albert H. Hastorf:

The Behavior of the Architect: Process and Product

► Some salient issues should be defined and some distinctions made, to induce some order among many ideas about research dealing with psychological aspects of architectural practice.

Distinction should be made between:

process of the creative act
result of the act or acts—the product or design

Psychological issues under process include:

selection of architects
training of architects
orientation toward end-use of empirical research
architect-client communication and interactions
(also under the product after completion of design)

What should the architect know?

The architect cannot be a Ph D psychologist.

Distinction to be made between:

researchable problems with bearing on architectural practice (effect of varying architect-client interactions on final design)
sophistication and useful information (interviewing techniques)

Basic vs Applied Research

Avoid entanglement in this verbal morass. There is a very tenuous dividing line between two types of studies: the creative process in architectural design—do we study the creative process as a general problem or do we need to do specific (and supposedly applied) studies of architects' creativity?

Questions at what level of generality?

We may be prone to make questions too global —"Can psychological studies of space perception lead to the more effective design of building interiors?" leads to the answer "Yes—but"— the "but" meaning that one must specify the problem *down* to some workable level.

Relation of Science and Art

There is no conflict between science and art because they are generically very similar. Oversimplified—human experience (knowledge) is a function of the perceptual process and there is no way in which the perceptual processes of the artist and scientist differ. Oft-mentioned objectivity applies to the methods of observing a phenomenon. Science specifies conditions as explicitly as possible so that the study can be repeated with the same results. Objectivity does not reside in the observer, qua observer. The experience (or the creation) of the artist does not have to meet repeated verifications. The artist can make use of certain scientist-gained knowledge to increase the effectiveness of his own creations.

Values

There is no issue more filled with pitfalls. There is a strong tendency to believe that if people from some other discipline would only talk plain English they could answer a general question such as "is this design psychologically good for man?" The psychologist cannot answer—"good" is undefined.

Another type of question concerns prediction. The architect and planner may ask the sociologist and the economist what will be the pattern of suburban living fifty years hence, the goal being to design communities and houses that will be "good" or functional. The predictive capacity of those disciplines may serve to assist in the design process, but the converse should not be overlooked—present designs affect behavior and can serve to shape the pattern of future living and working.

Behavior of the Architect

The crucial problem underlying aptitude and interest tests and proposed changes in curriculum is that of criteria of success. Any research must depend on a set of criteria relating to scholarship, or earning capacity, or productivity, or creativity, or a synonym for such concepts.

The statement that added courses in social science, space perception or interviewing techniques,

etc., "will make them more effective" requires some definition of "effective."

Creativity

A considerable amount of psychological research is now being done on creativity *per se,* involving investigation of accompanying abilities, life-history correlates and the role of the working situation. Recent studies of outstanding scientists investigated their origins, training and psychological test behavior. If architects could agree on a definition of creative design, a similar approach could be made.

Data Processing—Design

Psychologists, mathematicians and engineers have become involved in systems analysis research. In order that certain decisions can be reached, a lot of data have to be processed for which there are more or less effective ways.

The architect has to process a great deal of data and come up with a decision (a design). In what order does he obtain these data, or make "small" decisions, many of them irrevocable? He is no doubt overwhelmed, and too little time is spent on integrating data, which is the real essence of making a design.

There may be better ways of getting the data. There may be alternative and better ways of ordering the decisions. The teaching situation might be used as a "laboratory" for comparing alternative ways of organizing the design process.

Psycho-physical aspects of Design

Psychologists know a good deal about visual space perception. There may be some general rules of value to the architect.

The real issue is whether the psychologist can provide data helpful in specific design problems as they arise. It is possible to abstract some of the variables so that they can be experimentally manipulated. Solving only one specific problem at a time, and with pilot experiments, it may in time be feasible to build up classes of data.

The same propositions apply to analyses of color phenomena.

Behavior and physical arrangements

It has been demonstrated that arrangement of dwelling units affects the types of social groups. Given a desired working group or a pattern of living, how can they be promoted by physical arrangements or by design of a structure? Other problems are exemplified by housing for the elderly, special hospital wards and mental hospitals.

If problems or special demands are phrased quite specifically the psychologists can gather data of real help in promoting certain kinds of behavior. There is some existing useful knowledge but most of the interesting questions that can be asked will need new experiments to answer them.

Other potential areas for research are the architect's interaction with clients, other architects, and with society.

Architect-client

So little is known about conditions for a happy productive relationship, basis of selection of architects, expectations and causes of pleasure or disappointment with results. Diagnostic studies are certainly indicated, with interview studies as a start.

Architect-architect

There is an increasing amount of group practice and of interdependence between architect and specialists. It always seems that someone feels threatened, and we know all too little about such interaction. Research on the medical profession indicates that issues can be clarified toward solution.

Architect and Society

A series of problems here concern also the sociologists: What is the public's image of the architect, its expectation; the architect's image of his own professional role, conflicts and concerns? These all can be probed yet so little is known.

There are also questions of the profession's responsibility to educate the public which accepts what is, unaware of what might be. Responsibility outweighs the fear of unprofessional conduct. Indicated studies are on the public's state of sophistication and effective ways of changing it.

Possibilities and Limitations of Psychological Research

Even given certain knowledge about how the human organism functions (in terms of perceiving, learning, etc.) the psychologist still cannot come up with any *rules* about how to design a building. It is doubtful whether psychologists can specify any laws of "good form" (Gestalt psychologists to the contrary).

Some questions may be explored in terms of effectiveness of human functioning, with careful preciseness of the question and indication of functions to be maximized.

Psychological sophistication and research techniques can be of real help. Science is not an auto-

matic or magic helper. Asking the right questions and getting answers takes time. Architect and planner cannot avoid "what ought to be" questions and science cannot answer them but may well provide information to make the guesses more educated.

Meaningful research problems will emerge only from intensive discussions between architects and psychologists which will require that some architects gain sophistication regarding psychological research and that interested psychologists acquaint themselves with architects' problems ◄

Donald L. Foley:

Architectural Research from a Sociological Perspective

► Sociology studies social environment embracing persons, social organizations and culture. This involves not only other people as important ingredients of any one man's environment, but also an organizational aspect including the positions or social roles that people fill. There are expectations or norms as to how persons will perform in various roles—the great web of expectations, as to outlook, motivations, etc., constitutes culture. Much can be learned from other disciplines.

Sociology—A Holding Company of Diverse Interests

Social organization: division of specialized effort for complex tasks, integrated into a single ongoing activity system.

Institutional segments: family, government, religion, etc., also formal and informal organizations, bureaucracy.

Individual behavior: modified or influenced by social environment and the converse.

Values: shared assumptions or convictions re what is preferred or right—essential elements of culture and social organization. (Research interest shared with social anthropologists.)

Population: quantitative studies of increase, movement, etc.

Human ecology: adaptation of social organization to physical environment—interrelations of functional organization, technology and spatial patterns of communities. (Geographers have related interests.)

Psychology focuses on the individual and his physio-psychological mechanism, while sociologists emphasize the importance of the group factor, the social environment mediating human reactions to physical environment and to other individuals.

Sociologists may be differentiated as between the "hard data" group insisting on measurable, quantitative sources of empirical data, and those who question such approach to some phenomena most deserving of study.

Possibilities for Basic Architectural-Related Research

Too much should not be promised in the name of research. "Researchism"—the uncritical notion that research is a panacea for any and all problems can be as unfortunate as "scientism." Many problems of clinical nature faced by the practitioner contain so many variables and call for such exercise of judgment that they are not reducible to clear, researchable terms.

Research cannot be a substitute for the clear determination of goals. In many cases research will only provide a greater understanding of reasonable limits of choice and prevent serious errors.

Research should lead to better choices among alternative approaches. The research mind in the profession, or in the office, should constantly be asking: On what basis do you select this alternative rather than that one? How much difference would it make if you used alternative A, alternative B or alternative C? What is the assurance that the use of concept X will bring about Y reactions?

The spirit and methodology of research should improve the quality of analysis employed by practitioners and by design students. Students should be exposed to research, not only to develop more career researchers, but to develop a respect for what can be expected from research, ability to ask intelligent questions, and an attitude conducive to support of research, all to the end that architectural practice may be more adequately supported by knowledge.

RESEARCH AND THEORY

Theory is a body of interlocking propositions. For practical use the number of variables is reduced from those of actual experience but still apply, without serious inconsistencies, to many possible relationships and changes.

Practice Theory

Each profession needs to develop appropriate theory, which may take the form of "practice theory." Such theory is consistent with related scientific theory and similar to academic theory, but makes assumptions concerning goals of professional action (good health, beautiful environment, etc) and focuses on the attainment of these goals.

The formulation and refinement of *architectural practice theory* is the central task of architectural research. What is basic in architectural research

cuts across the distinction between basic and applied, and involves a range of explorations tied together by chains of reasoning such as applied in practice.

As a minimum such reasoning should take into account:

value goals of professional effort
how people use architectural structure and space
how spaces are created, perceived and reacted to
how structural systems work
how materials work
how architect selects alternatives

Specialists in architectural research will be responsible for weaving together:

understanding of architectural practice
rudiments of theory formulation
potential contributions from many fields

Some problems of architectural concern such as creation, use and perception of space will be found to be under-researched by other fields. Theory in other fields may not be well adapted to architectural problems. Therefore architects should confidently build their own central theoretical framework against which to judge the relevance of research findings by others.

ARCHITECTURAL RESEARCH NOT TYPICALLY SCIENTIFIC

The goals of professional effort may be clarified by scientific research but they also reflect surrounding culture values and professional traditions. This sort of research requires sensitivity to human needs, professional responsibilities and understanding of codes and other governmental influences.

Architecture has traditionally drawn heavily from the arts and humanities. Experimentation and key ideas as to space design may come from visual-art fields. Exploration of such ideas calls for approaches other than customary scientific methods, although they may be reformulated into hypotheses for scientific examination. Practitioners deserve more than "rule-of-thumb" or "seat-of-the-pants" operating concepts. A major profession should not trust to chance that the experience of previous or recent design periods is systematically passed down. Architects deserve tested laws showing performance of designs as several dimensions or factors are varied, information to throw light on how much difference it makes whether the design is handled this, that or some other way.

COMPARATIVE ANALYTIC STUDIES

Architects need to conduct research on how to analyze alternative design possibilities.

Design-researcher teamwork is called for, combining the inclination of the designer to provide new solutions and the interest of the scientist in comparative and experimental research. Some collaborative studies have been done abroad, notably in Sweden. Vernon De Mars, AIA, deliberately used different house-siting patterns in two halves of a resettlement project, hoping that someone would study the difference it made to people, but the research was never done.

Economic factors are also involved. The highway engineer manipulating cost and performance data for different thicknesses and mixes of concrete determines a specification that best balances low cost and high performance.

There is an important distinction between the researcher's experimental analysis, involving a few variables, and the architect's design-decision process involving dozens or hundreds of variables. The human mind, superbly capable of complexities and subtleties, serves as its own computer.

Potential Architectural Research

The ancient architectural criteria, Commodity, Firmness and Delight suggest equivalent major divisions of architectural practice theory: functional, structural and esthetic. The structural concept is of least concern to sociology or other social science.

The sociologist stresses the importance of the social environment as a factor intervening between the architectural-physical environment and the persons accommodated by it. Diagrammatically:

1 Physical environment created by the structure(s) and space(s)

▼▲ ▼▲

2 Social environment within which people live ➤ ➤ 3 Individuals who live in or become encompassed by these environments

For structure and materials, for instance, focus on (1) is sufficient. From a physio-psychological viewpoint we need analysis of the relations between (1) and (3).

The sociologist reminds architects and other researchers that there are important chain relations from (1) via (2) to (3) or from (3) influenced by (2) to (1).

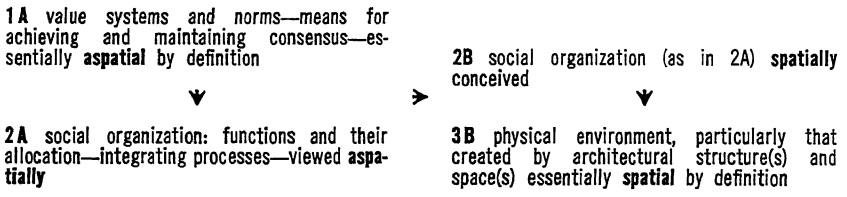
Social groupings encouraged by architectural spaces have their own kinds of impacts on the occupants. Reactions of persons to a building may be influenced by their background and by interaction with their equals or opinion-leaders.

SOCIAL ORGANIZATION OF OCCUPANT GROUPS

The research objective is the best possible understanding of group organization and function, pointing toward the best possible housing, space arrangement and quality.

In contrast to the architect's clinical task of diagnosis of each situation, the researcher's job is to identify classes or categories, to designate patterns, relationships or functions about which generalizations may be made and tested.

Diagrammatically, as a review setting for more specific research:


1A value systems and norms—means for achieving and maintaining consensus—essentially aspatial by definition
2A social organization: functions and their allocation—integrating processes—viewed aspatially
2B social organization (as in 2A) spatially conceived
3B physical environment, particularly that created by architectural structure(s) and space(s) essentially spatial by definition

A major chain of reasoning and interlocking propositions may be applied to any unit: family, business firm, manufacturing corporation, school, etc. Major sociological focus would be on 2A the objective, a sophisticated classification of *kinds* of units in terms of the architect's concern. We need research in method to equip the architect with the best analytic concepts and techniques.

Most important: a systematic study of fundamental relations between steps 1A to 2A, 2A to 2B and 2B to 3B.

1A to 2A relates values and functional organization alternatives and may reveal discrepancies between professed values and functional organization, part of the architect's problem.

2A to 2B is critical for architecture, the transition from aspatial to spatial, in which the architect should be strong in professional advice supported by tested principles. The objective: to determine effect of variation of space arrangement on the functioning of an organization.

2B to 3B is primarily architectural and less amenable to sociological study. Organization and architectural space are separate entities. Organization may change during life of a structure, which may impede growth and change. This is physical environment lag. Research objective: alternative ways by which structures may handle inevitable functional change—how well do loft-style large office buildings work over a long-time period?

SOCIAL FACTORS RELATED TO PERCEPTUAL AND/OR ESTHETIC REACTIONS

Research on perception is largely a concern of psychology, but should involve study of the effect of the social and cultural situation or climate on individual or group perception and attitudes.

We lack systematic studies of reaction of socially classified persons to specific kinds of architecture. What basis can be developed for forecasting public reaction to buildings? Architectural historians serving as critics attempt to interpret relations between style and social periods and forces, but we have no rigorous comparative empirical study of conditions of popularity of kinds of architecture.

Beyond knowing facts about people's reaction to architecture, the architect has further responsibilities on behalf of "the public interest." His practice theory must include a clear sense of his role as a member of an elite that is charged with providing structures of good taste.

SOCIOLOGY OF THE PROFESSION

The research spotlight should be directed at architecture as a profession to show the profession's subculture and traditional approaches to design process, external forces and the adaptability to changing needs, comparison with other professions.

The 1954 Survey Commission Report, *The Architect at Mid-Century,* marked a singularly notable effort at self-examination on the part of the profession. Continuing research is warranted to hold mirrors up to architects, to identify the assumptions that architects most readily take for granted and lose sight of because they seem so "natural."

A most important research subject is architectural education. There are important questions as to the roles assumed by graduates and others in the total area of functions and skills in addition to the key designer. ◄

RESEARCH PROJECTS

*Suggested or reported by conference participants**

1 METHODOLOGY OF ARCHITECTURAL RESEARCH

1 A master outline for advanced architectural research
2 Ways of financing architectural research, including development of public demand as prerequisite to substantial support
3 Modus operandi for interdisciplinary frontal attack on architectural research
4 Use of new techniques in systems or operations engineering
5 Role of schools with respect to research —development of research talent
6 (Current project): *Policy statement on architectural research* for the College of Architecture, University of California, Jan. 1959

2 COMMUNICATIONS AND DOCUMENTATION

1 Collection, classification and dissemination of past and present research findings
2 Information technology that will place at architects disposal in usable form the enormous mass of available information he needs
3 Communication by architects with each other and with the public of major generalizable ideas developed in the course of designing a building
4 Study of architectural drawings, graphic arts and writing as a basic form of communication with the audience they serve—is there a better form?
5 Feedback of information from job investigations being made daily but lost in individual files
6 Architectural history—documentation of special building types
7 A study of humor in architectural design
8 (Current project): *"Building Science Directory"* published annually by Building Research Institute, lists building industry associations, societies, organizations engaged in research—their research programs and publications

3 ARCHITECTURAL THEORY

1 Bridging the social and physical sciences: principles of transition from aspatial considerations to spatial arrangements
2 Kinds and sequence of information needed by the architect for design
3 Analytic concepts and techniques, including effective analysis of alternative design possibilities
4 Principles of the creative processes—thinking, reasoning, intuition and systems of alternative development
5 General rules of visual space perception and color phenomena applicable to specific design problems—an orderly rationale for esthetics as preparation for "the intuitive leap"
6 Use of predictive capacity of other disciplines to help present designs fit future needs—or should present designs shape the pattern of future living?
7 Social responsibility of the architect to raise design standards held by the public to higher standards
8 Clear statement of architectural theory, principles and objectives to encourage better practice and comprehension of architecture
9 The basic issues of civic design—enlargement of concept of scale and scope of design to include urban and regional design.

4 FACTORS AFFECTING ARCHITECTURE

1 Design impact of the client
2 Crucial decisions and points at which they occur in evolution of architectural form
3 The effect of mortgage policies on architectural design
4 Impact of technological change on architectural design
5 Psycho-physical basis for color preference and selection in architecture
6 Physiological and psychological lessons learned from experiences with atomic submarines and space vehicles, and their application to building standards

Examples of completed or current projects:

7 Influence of climate on architecture. Princeton School of Architecture
8 Human relations considerations in the architectural design of offices. College of Architecture, University of California
9 The following projects at Engineering Ex-

*These hundred-odd suggestions have been gleaned from several hundred to indicate some possible areas and subjects. None of the new proposals has been evaluated by the committee—for researchability, support or potential value.

- characteristics of people recruited into architecture
- effect of training on the architect as a person
- analysis of the architect's role conflict (art versus marketplace)
- case histories of architect-client relationship

2 Issues raised by group practice or interaction between architect and architect, or between architect and specialists
3 Sociology of the architectural profession
4 Goals and methods for the architect to assume community leadership as a means of effecting needed environmental changes
5 Role of the architect in urban studies
6 The architect's responsibility on behalf of "the public interest" as compared with merely satisfying the client
7 Criteria for true professional architectural services; conveying these criteria to society in intelligible form
8 Study of owners' preference as interpreted by developers of tract residential building —role of the architect in this field
9 Principles of management and sales relations applied to architecture as a business, especially to the problem of getting and keeping clients
10 A comparative study of methods of remuneration for architectural services
11 Adaptability of architectural profession to changing needs or revised interpretations of these needs
12 (Completed project): *"The Architect at Mid-Century."* 2-volume report of AIA Commission for the Survey of Education & Registration 1954

10 RESEARCH IN RELATED FIELDS

A Acoustics

1 Effect of acoustical treatments on the quality of sound as distinguished from volume
2 (Current project): *Effects of landscaping on sound,* Engineering Experiment Station, Texas A&M College

B Economics

1 Economics of reusing plans for buildings
2 Comparative analysis of construction industry with other industries

Completed or current projects:

3 *Planning criteria and methods for building conservation; a study of San Francisco as an example.* College of Architecture, University of California
4 *A study of the useful life span of school buildings,* College of Architecture and Design, University of Michigan
5 *Methods of reducing the cost of public housing,* School of Architecture, Pratt Institute

C Environmental Health

1 Treatment of domestic, industrial and municipal sewage (no significant advances in four decades)
2 Problems of liquid and industrial waste disposal associated with increased demand for water supplies due to metropolitan and industrial growth
3 Control of water and air pollution by industry, including radioactive substances
4 The physics of environment: study of temperature, humidity, air movement, illumination and noise as a means of achieving physiological well being through control of mechanical systems, insulation, lighting and acoustics

D Planning

1 Design objectives in urban and suburban residential neighborhoods
2 Better patterns of urban land use—radial instead of concentric?
3 Predictable trends in scientific and community development
4 The planning process; how to make it more than a static and negative means of regulating what people are going to do anyway when they get around to it

Completed or current projects:

5 *Perceptual form of the city,* sponsored by Rockefeller Foundation at Department of Architecture, MIT.
6 Housing Research Center, Cornell University:
Commuting patterns of industrial workers in the Northeast
Housing and journey to work

E Psychology, Physiology, Anthropology

1 Visual perception of architectural specifics of space
2 An approach to architectural design through exploration of anthropological factors and physiological relations

periment Station, Texas A&M College:
- effects of landscaping on natural lighting
- effects of sound on buildings
- solar radiation and its effects on buildings

5 ARCHITECTURE'S INFLUENCES AND EFFECTS

1 Bridge-building between physical and social sciences: effect of spatial arrangements on functional organization
2 Effect of major alternative approaches on people—large apartment and shopping centers versus traditional communities
3 A systematic basis for clinical research on relationship between physical forms and the goals they are supposed to serve
4 Use of psychological data in designing spaces to induce desired reactions, as for children, elderly people, the mentally ill, etc
5 Constructed environments that have produced similar responses by peoples of various ages and cultures
6 Extent to which environment as created throughout history indicates evidence of conscious design effort—what part of conscious design philosophy is rationalization of an already determined form?
7 (Completed projects): *"Space for teaching"* and *"Building for learning."* Engineering Experiment Station, Texas A&M College

6 REACTION OF PEOPLE TO ARCHITECTURE

1 Effect of social and cultural forces on individual's perception and attitudes regarding the architect's end-product
2 Behavioral and emotional awareness and reaction to buildings, arcades, rooms, etc
3 Comparative study of conditions under which specific kinds or styles of architecture have or have not gained popular acceptance or acclaim
4 Analysis of fads and fashions that sweep across major building types
5 Systematizing predictable environmental reactions into known relations which, if built into structures, would produce desirable or avoid undesirable results
6 Elements of visual perception of color, space, scale, line and form
7 What natural values such as sunlight or grass, cannot be supplied by technological improvements—when may such natural values be ignored?
8 Psychological impact (perception) of cities (urban environment)
9 (Current project): *Studies of form and color.* Architectural Laboratory, Princeton University

7 EVALUATION OF ARCHITECT'S END-PRODUCT

1 Evaluation of completed buildings of various types in the light of original objectives and as affected by influences exerted during program and planning phases
2 Methods of follow-up to determine how satisfactory any structure is
3 Feed-back of evaluation of completed projects to the architect
4 (Completed project): *Measuring the quality of housing.* Housing Research Center, Cornell University

8 ARCHITECTURAL TRAINING

1 New systems of education, appreciation and interpretation to improve society's understanding of architecture
2 Correlation between school training and the roles assumed by graduates as they work up in architects' offices
3 Better preparation of architects and planners for full range of opportunities and responsibilities involved in new operating scale, where large projects are built quickly by single organizations
4 Program and function analysis
5 Study of need for organized training in field of "architectural sciences"
6 Extent to which architects should become sophisticated in terms of existing psychological information
7 Use of sound films and cartoons in conjunction with model analysis and testing to teach architects the feel of what goes on in structures
8 Architectural aptitude testing
9 Development of research talent
10 (Current project): Cooperative study by AIA, ACSA and Educational Testing Service: *Aptitude tests for admitting architectural students*

9 PROFESSION OF ARCHITECTURE

1 Professional behavior of the architect:
- image of the architect as held by the public—by architects

Completed or current projects:

3 *Social and psychological aspects of home lighting.* Housing Research Center, Cornell University
4 *"The rise of shells"* and *"Psychology of shells."* Articles in July '58 Architectural Forum

F Sociology

1 Analysis of occupancy requirements and trends as affected by rapidly changing technology
2 Effect of mobility on the character and role of institutions in the urban pattern
3 Effects of increased exercise of right of eminent domain due to increasing population and competition for land
4 Patterns for domestic life with extrapolation for 20 years hence
5 Social organization, organization theory and function of the client.

Completed or current projects:

Housing Research Center, Cornell University:

Housing and social values
Farm housing in the northeast
Housing and human values
Housing for the aged

G Structural Design

1 Use of electronic computers and other techniques for more rapidly evaluating probable behavior of structural systems
2 Methods of studying realities of structural behavior that go beyond the mathematics and mechanics of analysis, such as model analysis and testing
3 Extension of ultimate strength and limit design concepts, especially to structural forms for which unit-stress solutions are not available
4 Behavior of materials in complex structural shapes and under combined stresses
5 Redetermination of design live loads and utilization of probability theory to achieve a more rational relation between loads and strength
6 Sequence and relationship of certain mathematical curves to problems in structural analysis and construction of buildings

Completed or current projects:

7 *Development of thin-shell precast concrete roofs,* College of Architecture and Design—University of Michigan
8 *Research in stressed - skin structures,* School of Design, North Carolina State College
9 *"How firm a building foundation,"* article in August '58 Architectural Forum, describes research at various universities on soil behavior.

H Unclassified

1 Transportation techniques encompassing movements of people, goods, messages and ideas; their purposes and relation to land uses
2 (Completed project): Institute of Engineering Research, University of California: Real Estate Research Program, *Studies of Organization of the Home Building Industry*

11 EXAMPLES OF APPLIED RESEARCH (UNCLASSIFIED)

1 Composite studies of units of major building types in which a number of variables are kept unchanged while one of the factors is varied
2 Optimum balance of physical obsolescence of building components
3 Design criteria for various building types, methods of determining such criteria

Completed or current projects:

4 *Studies of plastics in housing.* Sponsored by Monsanto Chemical Company, MIT.
5 *School Plant Studies.* AIA Committee on School Building & Department of Education & Research
6 *The Cornell Kitchen* — product design through research. Housing Research Center, Cornell University.
7 *A study of the thin concrete hyperbolic paraboloid roof for the Cowboy Hall of Fame Building.* Sponsored by A-E for the building, University of Michigan
8 *Architectural photogrammetry* for (a) historic American building survey (b) building movements. Ohio State University.

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3 The behavior of the architect: process and product—Albert H. Hastorf
4 Architectural research from a sociological perspective—Donald L. Foley
5 Environmental hygiene and its meaning for architecture—M. Allen Pond
6 Planning and science—Burnham Kelly, AIA
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8 Recent projects reported in architectural magazines
9 Additional projects reported by Robert W. McLaughlin, FAIA
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11 Survey of the current status of architectural research at US Universities—Ezra D. Ehrenkrantz—30 January 1959
12 Policy statement on architectural research for the College of Architecture of the University of California—Donald Foley et al January 1959

CONFERENCE POSTSCRIPT

The program of research for architecture which is being submitted to the AIA Board at its meeting in November will reflect to a considerable degree the thinking of and suggestions made at the AIA-NSF conference. These have been reported above and in last month's issue of the *Journal.*

It must be obvious to the reader that the Institute will have to oversee a very large and expensive operation if it is to assume responsibility for the research discussed at the conference. The Committee on Research and staff must establish workable limits and provide creative leadership. In order to accomplish this, projects will be screened to determine whether they are researchable, whether they can contribute to the objectives of research and, if so, whether they can be financed and from what sources.

It is the considered opinion of the Committee on Research for Architecture that after initial AIA financing, major funds must and should come from society as a whole, from organizations both within the building industry and in other scientific fields which are interested and concerned with environment and shelter. This is not merely a pious hope. A reasonably careful sampling of opinion among persons who are knowledgeable in the field of research and research finance has been encouraging.

The work will be organized so that we can begin on a modest scale and gain experience for a fully developed program. We must operate interdependently with our own profession and the many others whose concerns lie in the same areas.

It is with sincere appreciation that on behalf of the Institute, the Committe on Research for Architecture expresses its thanks to the participants in the AIA-NSF conference, as well as to the members of the Steering Committee who responded so generously and ably in organizing this quest for knowledge towards a better total environment.

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